2011 R-VETS Binder

www.r-vets.org
INTRODUCTION

The most important example that we can set for those watching us is to respect our patients. Each time you approach a horse with patience, respect and understanding, you have the opportunity to change the way the owner and community see and handle their animals. This interaction has the potential to do more good than anything else we do.

Just as you are a product of your experiences, so is every horse you will ever meet. Patience, respect, and understanding will get you further much faster than bullying your patient. Our job is to teach by example. If we choose to use derogatory terms to refer to our patients, we not only demonstrate a lack of understanding of equine behavior, but we give our clients license to treat their animals poorly. Our patients are not crazy, they simply act like horses.

Horses are by nature, flight animals, and our patients frequently have minimal experience with people. Many have been labeled “broncs” after being manhandled. People are watching us work. When you choose to finesse a patient rather than bully it, you make an investment. The payoff occurs the next time you (or some other veterinary professional) work with that patient.

Learn to watch (and listen) every chance you get. So much of what there is to be learned comes from watching others work. Don’t cheat yourself out of these opportunities.

SAFETY

The safety of the patient, volunteers, and any observers is always of primary concern. Each situation must be evaluated and a common sense decision made as to the whether the procedure should be done. The ground covering and slope, location of fences and buildings, availability of skilled personnel, and presence of distractions that may frighten the horse must all be considered. These are elective procedures, which should only be done when it is safe.

- The safest place to stand when handling a horse is at the shoulder.
- Do not stand behind horses.
- Do not kneel or sit on the ground when working with or around horses, always remain on the ball of one or both feet.
- Do not stand directly in front of horses, except during dental procedures.
- When you are the handler, stay on the same side of the horse as the examiner.
- Never wrap the lead rope around your hand.
- Do not do anything you are uncomfortable with.
- Stay off of the “leg side” of any anesthetized patient. If you cannot do so, maintain a distance of at least six feet between you and the hooves of the patient.
- Never let a horse out of your field of vision unless you are at least 40 feet away.
- If a patient is wearing a speculum, always keep a hand on the nose.
- Do not hold anything under your arm or between your legs when you are handling or working on a horse.

The single most important thing that you can do to keep yourself, patient, and your client safe is to learn to admit when you are over your head.

If you are not completely comfortable with any given task, say so. Ask for help or find someone who has more experience to perform the task. Some of the horses we work with will need to be sedated prior to unloading. Some may not be unloaded at all. Do not remove a horse from a trailer if you are unsure. Get help.
The Most Basic of Notes on Handling

Beware of people who are all about showmanship or worse, claim they are “experts”. These are generally the people who will get you hurt. If they need to put on a show for you, I have to question how much substance they actually have. All of the true horsemen that I know are quiet, unassuming people and I have never heard one of them say how good they are.

Don’t make the mistake of looking at a particularly rough cowboy and deciding that he “cowboys” everything. Cowboys are the original horseman. Even if you don’t like everything you see you can frequently pick up a real gem or two from watching them work.

The single most important thing that you can do to learn about being a horseman is to watch every interaction between a horse and a person that happens around you.

- Watch how the horse responds to the person
- Watch how the person responds to the horse
- Watch how the horses response differs from person to person, as this will lead you to the people you can learn the most from

You cannot learn to read/handle a horse by reading a few paragraphs in this document. It takes years of experience, and many people, perhaps the majority of them, lack the basic observational traits necessary to see what is in front of them, and learn from it. Start by looking at yourself.

- Think about how you move and speak. This is all that the horse sees and hears. People who move and speak in fits and starts do not instill confidence in their patient.
- Every interaction that you have with a horse is a training interaction. You either train the horse that you are partners, but you are in charge, or you train the horse that it is in charge (some would say in this case that the horse trains you)
- Learn your limits- don’t start something that you don’t believe you can finish. Every time you don’t finish what you started you tell the horse you really don’t mean what you say.
- Mean what you say. Ask for what you want/expect firmly and clearly, but without bullying. You cannot expect a horse to do what you ask if you are unclear or unsure when you ask.
- Approach every horse with the belief that everything is going to go well, and that you will be able to complete the task at hand. If you don’t think that you can complete the task at hand, do not approach the horse. (you may work on mastering this for the rest of your life)
- Horses follow your lead. If your body, voice, or manner says that something may go wrong, the horse knows, and things go wrong. (they read this as “run for your life, we are going to die” and nothing you want from the horse is going to be more important than its self preservation)

How do I know if I can go into a trailer and sedate/anesthetize a horse?

- I look at the patient’s eye. If it is “soft” it is looking for a friend. These horses are generally not a problem for me.
- A large portion of the animals we work with have not been touched, or are very green. It is rare to find a green horse that is not looking for a friend. All I have to do is be that friend.
STAYING ORGANIZED

The most important thing that you can do to keep things moving smoothly and safely is to stay organized. We have caddies and bucket organizers designed to keep the supplies that you need readily available. Do not carry armloads of supplies to your patient or to the area in which you will be working. Every time you use something, put it back where it belongs. Keep caddies and buckets clean and stocked. If everyone completes each task that they start, this is not an issue. Every chance you get, clean the clutter, empty the sharps, empty the trash, put the records away. This will make everything run smoother, I guarantee it.

PHYSICAL EXAMS

At times we are unable to perform a physical exam on our patients. They often lack the training necessary to facilitate examination. As a patient becomes excited, sedatives become less effective, making it more difficult to achieve sedation in the patient. Then if the patient is a surgical case, anesthesia and recovery are compromised.

Do not compromise the patients’ anesthesia and recovery, as well as your safety, by trying to take an obviously healthy horse’s temperature.

Normal physical exam parameters: (these parameters are relatively unchanged by anesthesia)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>99.0 to 101.8</td>
</tr>
<tr>
<td>Heart beat</td>
<td>32 to 44</td>
</tr>
<tr>
<td>Respirations</td>
<td>12 to 24</td>
</tr>
</tbody>
</table>

The heart beat should be regular. An irregular beat should be evaluated prior to anesthesia or sedation. A regularly irregular beat (i.e., 3 beats, a dropped beat, 3 beats, a dropped beat) usually indicates a 2nd degree AV block. This is a relatively common arrhythmia in the horse. In most cases this will not affect anesthesia. An irregularly irregular heart beat may be indicative of atrial fibrillation. This is a more uncommon arrhythmia, and requires further evaluation.

The nose should be free of discharge and the patient’s eyes and coat should be bright. The patients should be alert and should have an energy level appropriate to its age.
A Body Condition Score or BCS will be recorded on every patient. Note cards are attached to every caddy and clipboard. Refer to these cards, touch your patient, and assign an appropriate number.

### VACCINES, ANTHELMINTIC AND OTHER MEDICATIONS

All medications should be given for a reason and a cost/benefit ratio should be considered: There is no medication that cannot cause an adverse reaction.

- TMS can give the patient a life threatening antibiotic induced colitis.
- Adverse reactions to vaccines may include high fever in the day or days following the injection, swelling at the injection site, abscess formation, and anaphylaxis.
- Penicillin can cause anaphylaxis, or an excitatory response, either of which can result in serious injury.
- Intramuscular injections of non-antibiotics such as vitamins or flunixin can cause Clostridial myositis, which is life threatening (rarely even standard vaccines can do this: always take post vaccination lethargy and swelling seriously).

In the USA we de-worm and vaccinate horses who are presented for a dental procedure, a lameness workup, or a surgical procedure such as castration, hernia repair, or exploration of a wound or draining tract. While we will train residents to give anthelmintics and vaccinations to their horses we do not do “vaccination only” appointments for equine patients.

Ivermectin
Our Anthelmintic of choice is Ivermectin. We use 1% injectable solution for cattle, however we ALWAYS administer this orally. It is dosed at 200 mcg/kg or 1 ml/100 lbs of body weight.

The frequency with which a patient needs treatment for intestinal worms varies greatly.

- For a horse living on thousands of acres on the plains, twice a year (once after the first freeze in the fall and once when things start to thaw out in the spring) is entirely appropriate.
- For horses living in irrigated fenced pastures, once a month may be necessary.
- If a patient appears particularly “poor” we send a dose of ivermectin home with the patient to be administered a month later.

Vaccines

- All vaccines require refrigeration.
- One multi-dose vial will be carried in the cooler in each caddy.
- Check the icepacks every time you reach into the cooler for a vaccine. During summer clinics they will need to be changed mid day.
- You can draw up several doses at the start of the day.
- The syringes must be clearly labeled.
- After each use the needle is changed and the syringe is re-loaded.
- If the syringe is contaminated in any way (aspiration of blood into the syringe or the tip of the syringe touching anything between needle placements) it is discarded and a new syringe is labeled.
- All syringes are discarded at the end of the day and replaced with new ones.

We carry tetanus toxoid and rabies vaccine on domestic trips.

Tetanus Toxoid:

- One ml of tetanus toxoid is administered IM to patients over the age of 8 weeks.
- Tetanus toxoid should be administered annually, as well as when a patient is injured or is undergoing a surgical procedure.
- To attain initial immunity tetanus toxoid must be boosted 3-4 weeks after the first vaccination.
- Until this booster is given, each tetanus toxoid vaccine is considered to be the patient’s first.

Rabies

Rabies vaccines should be administered annually to equine patients. The dose is 2 ml given IM.

Tetanus Antitoxin

- Tetanus Antitoxin is not a vaccine.
- It is a treatment administered to prevent tetanus, but it treats the tetanus directly, rather than providing stimulation to the immune system and thus causing the body to fight the disease. It is what the immune system would do itself if it had adequate prior exposure to the insult (tetanus).
- It is administered only to surgical or injured patients who have not been previously or consistently vaccinated for tetanus.

This syringe is contaminated as it has been set down without a needle protecting the tip of the syringe.
Tetanus antitoxin is administered IM at a dose of 1500 units. Packaging must be consulted to determine what volume is necessary to administer 1500 units. The antitoxin contains antibodies that afford the patient an immediate protection against tetanus toxins. There is a risk of acute liver failure in patients who receive a tetanus antitoxin. There is a higher risk of tetanus infection without the antitoxin. We feel that the risk is outweighed by the benefits.

Injectable flunixin meglumine (Banamine)

- It is dosed at 1.1 mg/kg and administered IV to:
  1. Surgery patients
  2. Patients undergoing significant dentistry.
- Because this drug is administered IV, the syringe must be used only once. The aspiration of blood into the syringe
  1. Contaminates the syringe, and
  2. Provides a perfect media for bacterial growth.
- This is a Non Steroidal Anti Inflammatory Drug (NSAID) and is administered to provide post-op analgesia.
- All NSAIDs are nephrotoxic (hard on the kidney) and ulcerogenic (hard on the stomach and GI tract) to varying degrees.

Procaine Penicillin G 300,000 U/ml

- Must be mixed thoroughly,
  1. Some brands take longer than others to mix
  2. Turn the bottle upside down and look at the base to ensure that it has been properly mixed prior to drawing PPG into a syringe.
  3. Failure to mix thoroughly results in administration of the procaine portion of the drug to the patient, while the antibiotic remains in the bottle.
- Should be drawn from the bottle at room temperature
- Should be administered warm. If cold, place the syringe under your arm to warm.
- Must be refrigerated after opening
- Is administered IM
- May be administered at doses ranging from 20,000 to 40,000 IU/kg.
- We use PPG to protect against clostridial growth (tetanus and gangrene) while the wound or surgical site is healing.
- When discussing penicillin with the client we must be clear. Many of our clients use the slow release, long acting penicillin Benzathine (150,000 U/ml) in their horses. **This drug is not effective in the horse as it is not possible to administer it in high enough volume to reach a therapeutic blood level.**

The Pharmacy:

- Trimethoprim sulfamethoxazole tablets
- Phenylbutazone tablets
- Metronidazole tablets
- Procaine Penicillin G injectable
- Nacxell injectable
- Excede injectable
- Flunixin meglumine injectable
- Carbocaine, Injectable
Lidocaine Injectable  
Assorted topical and eye ointments.  

**ADMINISTRATION OF INJECTABLE DRUGS: IM INJECTIONS**

Most injections given to horses will be Intravenous (IV) or Intramuscular (IM) injections. Students will generally not be asked to give IV injections to patients who are conscious, and will only give IV injections under direct supervision. Mistakenly injecting any drug into the artery will cause your patient to seizure and fall down or flip over backwards. This places the patient, yourself and the client at risk of serious injury and reduces the client’s faith in your ability and in the clinic. There is no excuse for an intra-arterial injection. Learn good technique and USE IT!

Syringes must be clearly labeled. Unlabelled syringes are garbage.

Syringes of carbocaine, vaccine and PPG may be used for more than one patient as long as they have not been contaminated. The needle must be changed after each injection. If the syringe is immediately reloaded, then all clinic participants can tell that the needle has been replaced, as you must do so prior to reloading the syringe. Do not remove a dirty needle and set the syringe down prior to needle replacement as doing so results in contamination of the syringe. All syringes used for IV injections are discarded after a single use.

Intramuscular injections may be given in the neck, semimembrinosus, semitendinosus, or pectoral muscles. Some clinicians also use the muscles of the forearms as well as the gluteal muscles. Use of the pectoral muscles is associated with a short lived edema. Use of the gluteal muscles is generally limited, as drainage of an abscess is difficult to achieve. The neck and Semis are the two most common sites for IM injections in the horse.

Intramuscular injections in the adult horse should be given using a 1 ½” needle. Less viscous products such as vaccines, or gentamicin should be administered with a 19 ga or 20 ga needle while more viscous solutions, such as procaine penicillin should be given through an 18 ga or needle (a 20 ga needle can be used in foals as the volume is quite small).

The area of the neck used for injections is bordered by the scapula, the nuchal ligament, and the spine. Prior to giving an IM injection, feel the neck. You can be certain you are above the spine if you feel where they are prior to choosing an injection site. Avoid use of the neck for IM injections in foals. They lack neck muscles and it is possible to inject into the spine. Avoid the use of the neck for viscous solutions such as procaine penicillin if the patient is very thin and lacks adequate muscle.

**Equine Injection Sites**

- Correct site for injection of the semimembrinosus, and semitendinosus
- Avoid the points of the tuber ischia
- Note the change in orientation when the patient shifts weight
The following charts show dosing and syringe and needle size for the most commonly used medications on R-VETS clinics.

### EQUINE DOSING CHART

<table>
<thead>
<tr>
<th>Weight (lbs)</th>
<th>Procaine Penicillin G (PPG) (ml) 20,000 units/kg 10,000 units/lb</th>
<th>Banamine Flunixin meglumine (ml) 1 mg/kg 0.5 mg/lb</th>
<th>Ivermectin 1% injectable, ALWAYS GIVEN ORALLY 1.0 ml/100 lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>4.0</td>
<td>1.0</td>
<td>2 ml</td>
</tr>
<tr>
<td>220</td>
<td>7.0</td>
<td>2.0</td>
<td>3 ml</td>
</tr>
<tr>
<td>330</td>
<td>11.0</td>
<td>3.0</td>
<td>4 ml</td>
</tr>
<tr>
<td>440</td>
<td>14.0</td>
<td>4.0</td>
<td>5 ml</td>
</tr>
<tr>
<td>550</td>
<td>18.0</td>
<td>5.0</td>
<td>6 ml</td>
</tr>
<tr>
<td>660</td>
<td>21.0</td>
<td>6.0</td>
<td>7 ml</td>
</tr>
<tr>
<td>770</td>
<td>25.0</td>
<td>7.0</td>
<td>8 ml</td>
</tr>
<tr>
<td>880</td>
<td>28.0</td>
<td>8.0</td>
<td>9 ml</td>
</tr>
<tr>
<td>990</td>
<td>32.0</td>
<td>9.0</td>
<td>10 ml</td>
</tr>
<tr>
<td>1100</td>
<td>35.0</td>
<td>10.0</td>
<td>11 ml</td>
</tr>
<tr>
<td>1210</td>
<td>39.0</td>
<td>11.0</td>
<td>12 ml</td>
</tr>
<tr>
<td>1320</td>
<td>42.0</td>
<td>12.0</td>
<td>13 ml</td>
</tr>
</tbody>
</table>

### STANDARD SYRINGE AND NEEDLE SIZES

<table>
<thead>
<tr>
<th>DRUG</th>
<th>SYRINGE SIZE</th>
<th>NEEDLE SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPG</td>
<td>35 cc</td>
<td>18 ga, 1 ½”</td>
</tr>
<tr>
<td>Banamine</td>
<td>3 cc to 12 cc (dose dependant)</td>
<td>20 ga 1 ½”</td>
</tr>
<tr>
<td>Carbocaine, Lidocaine</td>
<td>35 cc or 60 cc</td>
<td>18 ga 1 ½”</td>
</tr>
<tr>
<td>Ivermectin</td>
<td>12 cc or 20 cc</td>
<td>N/A (oral)</td>
</tr>
<tr>
<td>Vaccines</td>
<td>3 cc</td>
<td>20 ga 1 ½” or 22 ga 1” or 1 ½”</td>
</tr>
<tr>
<td>Tetanus Antitoxin</td>
<td>3 cc or 5 cc (volume dependant)</td>
<td>20 ga 1 ½” or 22 ga 1” or 1 ½”</td>
</tr>
<tr>
<td>Anesthesia Topper</td>
<td>3 cc or 6 cc</td>
<td>18 ga 1 ½”</td>
</tr>
</tbody>
</table>

NOTE: All anesthesia “toppers” must have an 18 gauge 1 ½” needle on them. If you are doing equine work you must check the needle on all toppers and ensure that they are appropriate.
The importance of accurate records cannot be understated. A student or group of students will be assigned each evening to review the records for completeness and accuracy. They then will be used as a part of the rounds process. Our goal is not to criticize, but to use the records as a tool for teaching.

Records should be clear concise and complete, but not redundant. Be specific. If you have no history, write “history unavailable,” and include why, “Owner not present for exam,” “horse found on side of road”, etc. If a PE is not performed, circle this on the record and explain why.

Our records are very concentrated. Each section of the records has its own color. This system was designed to help you find the section in which you need to write.

As a part of the rounds process, we will review the records and discuss what entries could have been made differently. The records will also be used to complete the daily tally.

Please pay particular attention to the following points

- The client must sign the form
- If a client has multiple forms they must sign each form
- Notes are a very important part of the records, please be thorough

Fill the form out as you complete the work (record surgical and anesthetic information, as well as n-saids and antibiotics as they are given)

Each record will accommodate 3 patients and has a dental chart and space for additional notes and prescriptions on the first page; the different sections of the form are shown below.
There are three methods of recording information on the forms

1. Grey type is meant to be a watermark. Write directly over this.
2. Where multiple possibilities are listed in black type, circle all applicable information.
3. Write in blank spaces.

Yellow--Patient information: patient number, weight, age, markings, name, BCS

- Patient number may not have been pre-assigned. In these cases they may be filled out in the evening when processing the information on the records.
- Age and BCS. DO NOT LEAVE THESE SPACES BLANK. For age and BCS use your note cards (they are attached to the caddies and clipboards) look at the teeth, feel the pertinent points on the body and assign a number to the boxes.
- Color-The second yellow line refers to the patient’s color(s), circle all applicable colors.
- Markings-The third yellow line refers to any white on the face or legs, circle all options that are applicable.

White—all notes are recorded here. If you have written a complete record, anyone looking at the record will be able to tell you:

1. What the patient presented for,
2. What we found on physical exam,
3. What treatment was provided to the patient,
4. Why that treatment was chosen,
5. What the prognosis for the patient is,
6. What treatment options were discussed with the owner,
7. What recommendations we discussed with the owner.

If you have not included all of this information on your record, it is not complete.
Specifics of the patient history and procedure performed must be written in the notes section of the form. The initial note will reflect what the patient presented for, when and under what circumstances the client noticed the condition. There must be subsequent notes reflecting what, if anything, we did or did not do for the patient. The reasons for the treatment or procedure or for why a procedure was postponed, and what recommendations we made for the patients’ future should be clear.

There is adequate room on the record for notes. For those patients whose procedures/condition or recommendations to the owner require more space, there is a section for additional notes on the bottom of the front page. In addition, if the other notes sections were not used (surgery, anesthesia, and dental) you can utilize this space.

If a patient is anesthetized for farrier work you must record:

- If the anesthesia due to serious pathology, patient behavior, or for the owners convenience
- Which hoof or hooves were worked on
- Was the work due to a prior injury? What injury? When did it occur?
- Was the work necessary due to a chronic laminitis?

The next section of the record describes what we did to or gave to the patient, and who was involved. The tan and grey sections are watermark sections. Write directly over the grey type.

Tan – Record who treated the patient.

Grey – What we gave to the patient

- Ivermectin, flunixin and PPG, you will record the number of mls given to the patient, as each patient will receive a different dose. Simply write the number in the box. Use your dosing note cards to choose an appropriate volume
- For Tetanus Anti-Toxin, Tetanus Toxoid, Rabies and Rx you will simply X or check the box. If a prescription was given to the patient you must record this at the bottom of the front page

Blue- What procedures were performed on the patient. All treatments are rated as a 1, 2, or 3, based on the amount of time they would take a skilled professional to complete. Circle the appropriate procedure and number.

1 = 0-15 minutes
2 = 15-30 minutes
3 = 30 minutes or more

Purple - Dental: There are two parts to the dental record, a chart and a ‘circle what you did’ section.

Each patient has a circle what you did section.

<table>
<thead>
<tr>
<th>Dental exam performed</th>
<th>No work needed</th>
<th>Work performed</th>
<th>charted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rostral Hooks 106 206</td>
<td>Caudal Hooks 311 411</td>
<td>Diastema(s)</td>
<td></td>
</tr>
</tbody>
</table>

Circle all items that apply, and specify which teeth were involved for hooks, diastemas, missing teeth and extractions.

- An “X” indicates a missing tooth.
- A “D” between two teeth indicates a diastema (a space between teeth).
- An “E” over a tooth indicates an extraction.
- The mark out shown below on the upper incisors indicates that the teeth have been worn to the gums.

Green - Surgery, circle:
1. Surgery performed.
2. All items applicable to the castration that was performed.
3. All information regarding
   a. the block(s) performed
   b. ligatures placed

4. Surgical notes. These should contain, but are not limited to:
   a. All complications and how they were handled
   b. Details pertaining to the surgery not reflected elsewhere.
      i. If looking at a wound potentially connected to a synovial structure there will be an
         attempt to inject the structure to determine if it communicates with the wound.
         (remember to get as much history as possible and put it into the history portion of the
         record).
      ii. What and how much was used for injection?
      iii. What was the result? Communication, no communication…

   c. Details pertaining to the cryptorchid
      i. Inguinal canal stretched?
      ii. Sutured?
      iii. Skin sutures?
      iv. Hemicastrated previously by owner?
      v. Previous scar located? On which side?

Pink & White—Anesthesia

<table>
<thead>
<tr>
<th>Drug</th>
<th>X = Xylazine</th>
<th>T = Xylazine</th>
<th>V = Xylazine</th>
<th>K = Ketamine</th>
<th>Volume (mL)</th>
<th>Ketamine (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>time</td>
<td>time</td>
<td>time</td>
<td>time</td>
<td>time</td>
<td>time</td>
<td>time</td>
</tr>
</tbody>
</table>

**INDUCTION** Rough 1 2 3 4 5 Smooth **RECOVERY** Time Rough 1 2 3 4 5 Smooth **OVERALL ANESTHESIC**

<table>
<thead>
<tr>
<th>Total Anesthesia</th>
<th>X = Xylazine</th>
<th>T = Ketamine</th>
<th>V = Xylazine</th>
<th>K = Ketamine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Time</td>
<td>Time</td>
<td>Time</td>
<td>Time</td>
</tr>
</tbody>
</table>

**ANESTHESIA TIME START**

<table>
<thead>
<tr>
<th>Drug</th>
<th>X = Xylazine</th>
<th>T = Ketamine</th>
<th>V = Xylazine</th>
<th>K = Ketamine</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>time</td>
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</tbody>
</table>

**DEPTH** Light 1 2 3 4 5 Deep **POSTOP** Sedation Time Reversal Time Rol Time

<table>
<thead>
<tr>
<th>Time</th>
<th>Drug</th>
<th>X = Xylazine</th>
<th>T = Ketamine</th>
<th>V = Xylazine</th>
<th>K = Ketamine</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
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</tr>
</tbody>
</table>

**End**

<table>
<thead>
<tr>
<th>Drug</th>
<th>X = Xylazine</th>
<th>T = Ketamine</th>
<th>V = Xylazine</th>
<th>K = Ketamine</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>time</td>
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<td>time</td>
<td>time</td>
<td>time</td>
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</tbody>
</table>

**Total Time**

<table>
<thead>
<tr>
<th>Drug</th>
<th>X = Xylazine</th>
<th>T = Ketamine</th>
<th>V = Xylazine</th>
<th>K = Ketamine</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
<th>Top Off (mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>time</td>
<td>time</td>
<td>time</td>
<td>time</td>
<td>time</td>
<td>time</td>
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<td>time</td>
<td>time</td>
<td>time</td>
<td>time</td>
<td>time</td>
</tr>
</tbody>
</table>

All anesthetic drugs are recorded in mls. There is no need to write the word mls, it is implied. A time is recorded below the volume. The time of administration is **VERY IMPORTANT**. Please remember to record this.

There are spaces on the record to rate/record various aspects of the anesthesia process. These include

1. Induction (rate 1-5 see above)
2. Recovery (rate 1-5 see above)
3. Overall Anesthetic Depth (rate 1-5 see above)
4. Post op
   a. Sedation, this can be recorded cryptically. 1 X = 1 ml xylazine… (Remember to record the time)
   b. Reversal (volume drug time) only used in cases involving IM sedation. Very rarely used
c. Roll (time) only done in cases involving IM sedation. Very rare

5. Anesthesia start, end and total time.
6. Total volume of anesthetic drugs administered (this can be completed in the evening)

<table>
<thead>
<tr>
<th>Patient</th>
<th>Euthanasia Recommended</th>
<th>Client Signature</th>
<th>mins Euthanasia</th>
<th>Caudal Aorta Cut</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Drug Dispensed</td>
<td>Strength</td>
<td>Quantity</td>
<td>Dosage instructions</td>
</tr>
<tr>
<td></td>
<td>Drug Dispensed</td>
<td>Strength</td>
<td>Quantity</td>
<td>Dosage instructions</td>
</tr>
</tbody>
</table>

White-The last section of the front page contains 3 subsections.

- Euthanasia
  - Euthanasia Recommended. Circle
  - Client signature, should we need to euthanize a patient
  - Method performed
- Prescriptions. This is a watermark section, write directly over the grey type
- Additional notes

If dental work beyond a routine float has been performed, turn the patient care record over, and complete the dental chart for that patient.

**Patient Care Record and Discharge Instructions**

**IT IS VERY IMPORTANT THAT THE CLIENT GET THIS PAGE.**

The patient care record contains the patient’s discharge instructions and our contact information. In case of post operative complication the client must have the information on this page. It is the scribe’s responsibility to complete the discharge page. **IN A BUSY CLINIC THE CHANCES OF THE CLIENT LEAVING WITHOUT THIS PAPER IS VERY HIGH UNLESS YOU FILL THE FORM OUT DURING THE SURGERY AND HAND IT TO THE CLIENT BEFORE YOU MOVE ON TO THE NEXT PATIENT.** It is more efficient to complete this as you work, (one person in your team will be the scribe, and will complete the records)

**EQUINE PATIENT CARE RECORD AND POST SURGICAL INSTRUCTIONS**

<table>
<thead>
<tr>
<th>Patient</th>
<th>Patient Name or Description</th>
<th>Male Female</th>
<th>Age</th>
<th>Wormer Given</th>
<th>IV Prescrip</th>
<th>Vaccinations Administered</th>
<th>Vaccines Due On</th>
<th>Dental Work Performed</th>
<th>Farrow Work Performed</th>
<th>Castration Performed</th>
<th>Other Surgery or Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Jo-Jo</td>
<td>Female</td>
<td>26</td>
<td>12ml</td>
<td>----</td>
<td>Tetanus Toxoid</td>
<td>Rabies</td>
<td>7/21/09</td>
<td>7/1/10</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>2</td>
<td>Frankie</td>
<td>Male</td>
<td>3</td>
<td>12ml</td>
<td>----</td>
<td>Tetanus Toxoid</td>
<td>Rabies</td>
<td>7/21/09</td>
<td>7/1/10</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>3</td>
<td>Coyote</td>
<td>Male</td>
<td>2</td>
<td>12ml</td>
<td>X</td>
<td>Tetanus Toxoid</td>
<td>Rabies</td>
<td>7/21/09</td>
<td>7/1/10</td>
<td>----</td>
<td>----</td>
</tr>
</tbody>
</table>

Discuss follow up/post op care with the client during this time.

If the patient had hernia or cryptorchid surgery circle the discharge instructions on the page and discuss them with the client to ensure that they understand.

**POST CRYPTOCHID CASTRATION CARE INSTRUCTIONS**

Please rest the Cryptorchid patient for 2 days after surgery; then follow the post castration care instructions.
EQUINE CHECK IN SHEET

If the clinic will be high volume one person will be assigned to act as an intake coordinator. This person will be responsible for completing a client check in sheet.
The services which the client requires should be circled on the intake sheet when the client signs in.

When the services have been provided, the care provider completes the discharge form, gives the record to the intake coordinator, and marks what services were actually provided to the patient as shown below.
IV INJECTION BASICS

Knowing how to give an IV injection, knowing how to help someone give and IV injection, and knowing how to teach IV injection techniques are three very different things. The following attempts to address the most common problems that occur during the process of becoming skilled at Venipuncture. A thorough understanding of each of these points will allow you to develop the skill required to administer and to teach safe IV injection techniques.

To find the horses jugular vein;

1. Locate the jugular furrow
2. Depress/occlude the vein 3 to 6 inches below where you plan to puncture the vein and watch for the rise or filling of the vein. Once you are proficient at venipuncture, you will hold the vein off just below your puncture site, which will reduce the time needed to obtain adequate fill of the vein. When learning venipuncture it can be helpful during needle alignment to hold off well below the planned venipuncture site, this will allow you to visualize more of the vein, improving your alignment.

To aid in visualization:
   a. Raise the head. A taught vein will not roll or push away from the needle and is more easily visualized.
   b. Push the patients head slightly away from you while holding it up.
   c. Wet the hair with alcohol.

Ponies, burros, and very muscular or thick necked horses, can be more challenging. When learning, start with an animal with a slighter build.

Twelve Most Common Mistakes When Making an Iv Injection

1. Lack of commitment to accurate needle placement.
2. Lack of commitment to the act of needle placement
3. Incorrect location on neck
4. Incorrect bevel orientation.
5. Unable to see vein; Blind stick, or ‘stick and fish’ technique.
6. Assuming that aspiration of blood into the syringe is evidence of correct needle placement.
7. Misalignment with the vein or too large an angle of the needle during venipuncture
8. Failure to complete needle placement once venipuncture has occurred (Failure to bury the needle)
9. Inappropriate needle length (too short).
10. Subcutaneous needle placement prior to venipuncture.
11. The use of a dulled needle
12. Shift in position of hand (& syringe & needle) during aspiration

Point by point these can be expanded to:

1. Once you decide to place the needle, find the vein and DO IT!. Lack of commitment to the act of needle placement tends to result in repeatedly jabbing the patient.
2. IV injections should be given in the upper third to one half of the neck (closer to the head).
   Closer to the head of the horse there is a muscle between the artery and the vein, decreasing the chances of an arterial stick.
3. Closer to the body of the horse the artery is more superficial and closer to the vein. Venipuncture in this part of the neck increases the chance of an arterial puncture and injection. Until you have given thousands of jugular injections using sound

4. Placement of the needle into the vein should always be done with the bevel facing toward you.
   a. Venipuncture with the bevel incorrectly oriented increases the level of resistance to skin puncture, and may cause the bevel to rest flat against the back wall of the vein once venipuncture has occurred. This will occlude your needle.
   b. If you feel that you have placed the needle in the vein and yet there is no “flash” or drop of blood in the hub of the needle, occlude the vein and rotate the needle within the vein by twisting the hub.

5. Utilizing the stick and fish technique increases the likelihood that you will hit the artery.
   a. Take the time to find the vein before attempting venipuncture in your patient.
   b. If you believe you have found the vein, yet are unable to obtain a flash, rotate the hub of the needle as directed above.
   c. Do not pull the needle out or fish blindly for the vein.
   d. Take a few moments to think about where your needle is. Watch the needle while occluding and releasing the vein. The movement in the needle will help to identify where it lies relative to the vein. This is a learning exercise that will help you to become more accurate when placing your needle.

6. Placement of the needle and syringe as a single unit is common. It is, however, impossible to differentiate vein from artery by aspiration of blood into your syringe, and overestimating the depth of the vein is common. Until you have given thousands of IV injections utilizing sound technique, it is a good idea to disconnect the needle from the syringe during placement. Once the needle is placed, continue occlusion of the vein and watch for blood dripping from the needle. An arterial puncture will pulse.

7. Placement of the needle into the vein at too great an angle increases the risk of running the needle through the vein and into the artery. The Jugular vein is quite shallow.
7. Failure to completely advance the needle into the vein increases the risk of two common errors. First, you are more likely to lose the vein during your injection, causing perivascular drug administration. Second, if the horse swings into you during injection, the needle may be pushed deeper, causing an arterial injection. To avoid these problems, once the tip of the needle is within the lumen of the vein, advance the needle until all that is visible is the hub.

8. Choosing a needle that is too short increases the risk of losing the vein during the injection. If your patient moves after needle placement you are less likely to lose the vein when using a 1 ½” needle for the injection.

9. A needle placed using sound technique will pierce the skin and immediately enter the vein. It will not run subcutaneously before it enters the vein. This needle has been buried, however, only the very tip is in the vein. It is unlikely that it will remain in place for the duration of the injection.

10. Each time a needle punctures anything it becomes dulled. Dulled needles cause significantly more pain. For this reason a new needle should always be placed on your syringe prior to administration of an injection to an un-anesthetized patient.

11. Shifting the hand position (and needle, and syringe) during aspiration. Focus on:
   a. Maintaining the correct vein/needle/syringe alignment as you aspirate
   b. Maintaining a very still hand
AN INTRODUCTION TO FIELD ANESTHESIA

Important points before we begin this discussion;

1. Anesthesia involves more than simply looking at a chart and pulling up anesthetic drugs. Patient behavior, breed, age, the environment in which you are working, the availability of supplies, the skill and experience level of yourself and of those around you (surgeon, support staff and client), the position the patient will be in for surgery, and the expected length of the surgery, will all affect the protocols, dosing, and timing that you choose for each patient.

2. One of the most important things that you can learn in your Veterinary career is how to recognize and respond appropriately to being over your head. There are techniques covered in this presentation that I would not undertake unless I was working with experienced “handy” horsemen/practitioners, and or I/we felt that the patient’s life was in imminent danger.

3. Our protocols may be different from what you are used to, and there are reasons for the choices that we have made. Our choices are simple, safe, effective and utilize the supplies and equipment that are available to us where ever we happen to be working. They are affected by cost, time constraints, and the difficulty associated with performing rechecks on the patients that we see.

Injectable Anesthesia

A couple of notes before we undertake the issue of the basic protocol that we use, adjusting it to fit your patient and circumstances, and dealing with patients who you are unable to touch.

Jugular venipuncture in the horse is not difficult. This makes catheters unnecessary for routine cases

- This is an excellent time to learn to manipulate the patients’ position to allow for easier visualization of and access to the vein.
- Have a staff member show you the effect of
  1. Repositioning the head.
  2. Placing a pillow under the neck

- **Remember: IV injections are to be supervised by a staff member.**

There are four possibilities for maintaining anesthesia in the horse on R-VETS clinics after they have been induced. They are:

1. Intermittent injections of “top offs.” This is by far the most common method on our clinics (Xylazine at 0.125 mg/ lb and Ketamine at 0.25 mg/lb mixed in the same syringe).
2. Double drip: Xylazine (2.1 mg/kg/hr) and ketamine (7.2 mg/kg/hr) in a 250 ml bag of diluent, run through a 15 drop / ml admin set at 1 drop per second for maintenance of anesthesia during longer procedures.
3. Triple drip: Xylazine (500 mg), ketamine (1000 mg or 1 g), in a liter of 5% guaifenesin (50mg/ml), given at 1ml/lb/hr.
4. A combination of boluses of 5% guiafenisen (not exceeding 1 ml/lb/hr) and “top off” injections

In the event that the choice has been made to use double drip, triple drip, or boluses of guaifenesin, a catheter will be placed (guaifenesin is very irritating if administered perivascularly). This will take place after the patient has been induced.

**Important points regarding the use of these protocols.**
Injectable anesthesia on RVETS' clinics is performed on many patients who have never been touched. These horses:

1. Generally involve higher doses than a horses with more handling,
2. Are more challenging than the average equine patient, both behaviorally and anesthetically

- Optimally, you will administer a dose just adequate to anesthetize the patient for the procedure they are to undergo.
- Administering more than necessary will cause the patient to remain asleep for longer than needed and can compromise recovery.
- Administering a less than adequate dose does not become apparent until after the patient is let out of the chute. In this case, there are three possibilities:

1. The patient does not attain lateral recumbency
   - This patient must be run back through the chute
   - Requires another round of anesthetic drugs. The second round of anesthesia is administered as if the first round did not occur. (you start over and increase your doses)
   - The patient will become sternal, rather than becoming completely anesthetized. This patient must not be approached by anyone other than a staff member.
     - a. If approached in a way that is at all stimulating, this patient will rise and run off,
     - b. If possible, more anesthetics will be administered as quietly as possible
2. The patient will lie down and will not be at an adequate plane of anesthesia for the procedure. At this point all you can do is administer more drugs.  
3. Inadequately anesthetized patients tend to:
   - Require repeated “top offs,” which translates to more anesthetics than would have been necessary if the dose had been adequate to begin with.
   - Not become deeply anesthetized until after all stimulation ceases (until after the procedure is complete and they are left alone) after which the drugs reach the target receptors and they sleep for extended periods.
   - Have difficult recoveries.
     - a. This can be countered by administration of xylazine at the end of the procedure.
     - b. This allows the patient to sleep off the additional anesthetics.

Anesthesia maintenance is achieved by intermittent administration of xylazine/ketamine “toppers” or one of the other regimens described above.

**The Anesthesia Process**

- Evaluate your patient. If it is possible do a brief physical exam. If a “hands-on” exam is impossible or likely to “jack up” or excite the patient, skip it. Do not compromise the patients’ anesthesia and recovery as well as your safety trying to take an obviously healthy horse’s temperature.
- If it is not possible to do a” hands-on” exam, an “exam” of sorts can still take place. When deciding if anesthesia is safe without touching the patient you must ask yourself:
- Does the patient appear healthy? Even if the patient is underweight anesthesia may be safe. Some stallions when penned will pace the fence line and lose weight. This patient is unlikely to gain weight until it is castrated and returned to its’ herd. Patients living in rural Latin America tend to receive a very low plane of nutrition. Not castrating them will not improve this situation, and may cause them to use more energy looking for something to breed than they might if they were castrated. To make this decision, think about the following:
  - Is the hair coat healthy?
  - Are the eyes bright?
  - Is the patient energetic?
  - Is the patient likely to be castrated by its’ owner if we do not anesthetize it?
  - If these questions are answered yes, we are likely to anesthetize the patient, even if the BCS is as low as 2.

- If the answers to the above questions are no, then you must consider:
  - Is the patient a risk to the safety of those around it? If this is a 4 year old stud colt in a Latin American village where children or women with children strapped to their backs may be using the horse in the fields…
  - Does the patient require an exam to rule out causes of its’ physical state in order to determine if euthanasia is warranted or if treatment is possible?
  - Is there a crippling injury to a structure such as a joint in an unhandled horse? (Anesthesia for examination may be the only option.)

- If any of these questions is answered yes, we are likely to anesthetize the patient, even if the BCS is quite low.

REMEMBER: if we anesthetize a patient under ANY of the circumstances listed above, there must be clear notes in the record indicating the reason and reasoning behind the decision. If you do not understand why a patient was anesthetized, ASK. These discussions are a valuable part of the learning experience and make good rounds topics.

Your anesthetic plan will be based on:

1. Patient size
   Calculated doses are based on size

2. Patient temperament
   Dosing must be adjusted to account for fractious or excitable animals

3. Patient breed
   Burros and mules clear anesthetic drugs at a higher rate than horses
   Draft breeds (and foals) can be harder to read

4. Your skill level
   Until you have gained some experience you may want to keep the patient a little deeper

5. Skill level of the surgeon
   A less skilled surgeon will need longer to complete a given procedure

6. Skill level of the support team
   Always think through who is available to help if something unexpected happens

7. Patient positioning
Dorsal recumbency is more stimulating than lateral and will require more top offs

8. Use of Local Anesthesia
   Local anesthesia reduces the amount of stimulation to the patient

9. Expected length of surgery

10. Your surroundings / environment
    - If working in a really tight space, or on a surgery where your surgeon and support staff may be forced to work between the patient's legs, you may choose to keep the patient deeper
    - If working in a very loud environment you must consider how this will affect recovery, and what you can do to offset this effect.

11. Available equipment

<table>
<thead>
<tr>
<th>Drug</th>
<th>Our Basic Protocol</th>
<th>Range of Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Xylazine</td>
<td>1 mg/kg</td>
<td>0.3 to 1 mg/kg</td>
</tr>
<tr>
<td>Butorphanol</td>
<td>0.02 mg/kg</td>
<td>0.02 to 0.04 mg/kg</td>
</tr>
<tr>
<td>Diazepam</td>
<td>0.03 mg/kg</td>
<td>0.01 to 0.1 mg/kg</td>
</tr>
<tr>
<td>Ketamine</td>
<td>2 mg/kg</td>
<td>1.5 to 2.75 mg/kg</td>
</tr>
</tbody>
</table>

### ANESTHETIC DRUGS AND RANGE OF USE

<table>
<thead>
<tr>
<th>Weight In</th>
<th>Weight In</th>
<th>Xylazine ml</th>
<th>Butorphanol ml</th>
<th>Diazepam ml</th>
<th>Ketamine ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>lbs</td>
<td>kg</td>
<td>1mg/kg</td>
<td>0.02-0.04 mg/kg</td>
<td>0.03 mg/kg</td>
<td>2 mg/kg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.5 mg/lb</td>
<td>0.01-0.02 mg/lb</td>
<td>0.02 mg/lb</td>
<td>1 mg/lb</td>
</tr>
<tr>
<td>110</td>
<td>50</td>
<td>0.5</td>
<td>0.2</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>220</td>
<td>100</td>
<td>1.0</td>
<td>0.2</td>
<td>0.4</td>
<td>2.0</td>
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<tr>
<td>330</td>
<td>150</td>
<td>1.5</td>
<td>0.3</td>
<td>0.5</td>
<td>3.0</td>
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<tr>
<td>440</td>
<td>200</td>
<td>2.0</td>
<td>0.4</td>
<td>1.0</td>
<td>4.0</td>
</tr>
<tr>
<td>550</td>
<td>250</td>
<td>2.5</td>
<td>0.5-1.0</td>
<td>1.5</td>
<td>5.0</td>
</tr>
<tr>
<td>660</td>
<td>300</td>
<td>3.0</td>
<td>0.5-1.0</td>
<td>2.0</td>
<td>6.0</td>
</tr>
<tr>
<td>770</td>
<td>350</td>
<td>3.5</td>
<td>0.5-1.0</td>
<td>2.5</td>
<td>7.0</td>
</tr>
<tr>
<td>880</td>
<td>400</td>
<td>4.0</td>
<td>0.5-1.0</td>
<td>3.0</td>
<td>8.0</td>
</tr>
<tr>
<td>990</td>
<td>450</td>
<td>4.5</td>
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<td>9.0</td>
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<td>1100</td>
<td>500</td>
<td>5.0</td>
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<td>4.0</td>
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<td>1210</td>
<td>550</td>
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<td>600</td>
<td>6.0</td>
<td>0.5-1.0</td>
<td>5.0</td>
<td>12.0</td>
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</tbody>
</table>
ADJUSTING YOUR PREMED TO FIT YOUR PATIENT

<table>
<thead>
<tr>
<th>Premed</th>
<th>Standard Dose</th>
<th>Very Quiet Patient</th>
<th>No Butorphanol Available</th>
<th>Slightly Excited or Excitable</th>
<th>Moderately Excited or Excitable</th>
<th>Very Excited or Excitable</th>
<th>Intractable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Behavior</td>
<td></td>
<td></td>
<td></td>
<td>Just beginning to wind up</td>
<td>Not yet unmanageable</td>
<td>Close to or completely unmanageable</td>
<td>Unable to access vein</td>
</tr>
<tr>
<td>Xylazine Dosing Adjustment</td>
<td>Decrease by up to 50%</td>
<td>May Increase 10%</td>
<td>Increase 20%-25%</td>
<td>Increase 50%</td>
<td>Increase 80% - 100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xylazine Dose</td>
<td>1 mg/kg</td>
<td>0.75 mg/kg</td>
<td>1.1 mg/kg</td>
<td>1.2 mg/kg</td>
<td>1.5 mg/kg</td>
<td>1.8 to 2 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Butorphanol</td>
<td>0.02 mg/kg</td>
<td>0.02 mg/kg</td>
<td>-------</td>
<td>0.02 mg/kg</td>
<td>0.03-0.04 mg/kg</td>
<td>0.04 mg/kg</td>
<td></td>
</tr>
<tr>
<td>IM Detomidine</td>
<td>In selected situations where horse temperament or facilities present a danger to the patient or handlers we may use IM sedation. This will be done using detomidine. Following sedation the anesthesia process will proceed as with an un-sedated patient. This is because patients requiring IM sedation will be roused when approached and will be difficult to anesthetize. They should be approached very quietly and only with the help of skilled staff. We generally try to avoid the use of IM alpha 2 agonists due to increased difficulty of recovery. Improving the quality of these recoveries will be covered later.</td>
<td>20 – 40 mg IM 20 minutes prior to performing anesthesia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To begin the anesthesia process in your patient, start with sedation. Every effort should be made to this quietly. Learning to finesse the patient is an important skill that will pay off over and over in your career.

1. Xylazine + Butorphanol given IV in the same syringe (leave 18 gauge needle in place when possible)
   - Evaluate the degree of sedation achieved by this combination: Premature induction tends to result in
     a. Stiff induction
     b. Patient may paddle or swim in place after falling to the ground
   - Within 2 -5 minutes the horse’s head should drop below the level of the withers.
   - If this does not occur, another dose of xylazine (0.1-0.2 mg/lb) may be necessary.
   - Adequate sedation is important for smooth induction, adequate anesthesia, and safe recovery.

Generally the needle used to administer sedation is left in place in the jugular vein preventing another source of stimulation prior to induction.
ADJUSTING YOUR INDUCTION TO FIT YOUR PATIENT OR ENVIRONMENT

<table>
<thead>
<tr>
<th></th>
<th>Standard dose</th>
<th>Routine Environment Or Castration</th>
<th>Castration with ligation or cord splitting</th>
<th>Small area, need patient to rise soon</th>
<th>Large area</th>
<th>Crypt or hernia surgery</th>
<th>To patient away from chute before they drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diazepam</td>
<td>0.03</td>
<td>0.03</td>
<td>0.04</td>
<td>0.03</td>
<td>0.04-0.05</td>
<td>0.05</td>
<td>Choose appropriate column, No adjustment to Ketamine or Valium required</td>
</tr>
<tr>
<td>Ketamine</td>
<td>1.5 - 2.75 mg/kg</td>
<td>2.0 mg/kg</td>
<td>2.0 – 2.2 mg/kg</td>
<td>----</td>
<td>----</td>
<td>2.2 – 2.75 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Xylazine</td>
<td>To move patient further away from chute, or site of induction, do not allow patient to become very sedate after premed administer ketamine / valium / xylazine together and chase the patient away from the chute, only until adequate forward movement has begun.</td>
<td>~20 -- 30 % of original dose added to ket/val</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Once the patient is sedate, induce:

2. Administer Ketamine and Diazepam, slowly, IV mixed in the same syringe (remove needle). The horse will become recumbent in less than a minute.
   - If using a chute, open the gate immediately and wave your arms, a hat, or a rope at horse to encourage him to leave.
   - If performing a “hand induction”,
     a. drop patient on left side (if possible)
        - Elevate the head and turn slightly to the right.
        - Some anesthetists will lower the horse’s head and pull it slightly to the left.
        - A quiet induction is more important than dropping the horse on its left. The patient can be rolled over if need be.
     b. Do not attempt to knock the patient off of its feet as this will cause him to fight the process and may prevent his becoming recumbent.

3. Horse becomes recumbent.
   - Do not approach until the patient is fully relaxed.
     a. The anesthetist makes this call.
     b. The upper leg should be on the ground.
     c. DO NOT RUSH THE PATIENT.
   - After becoming recumbent the patient may be stiff and move their legs for a few seconds.
   - Once adequate anesthesia occurs, everyone must proceed with their tasks as efficiently as possible.
   - Everyone must remain on the neck/back side of the patient, (away from the legs of the horse).
   - If the patient does not obtain lateral recumbency a staff member will administer more anesthetics.
   - Nystagmus or tearing (lacrimation), muscle tone or strong palpebral reflex may be present.
• Place a pillow under head to prevent facial nerve paralysis
• Place a towel over the eye to minimize stimulation.

The anesthetist remains at the head of the patient at all times. They are “armed” with two doses of anesthetic “top off” consisting of 1 ml of xylazine to each 2 ml of ketamine (administered at a dose of xylazine, 0.125 mg/lb and ketamine, 0.25 mgs/lb) mixed in the same syringe. These “top offs” are used if the patient needs additional anesthesia. Prior to the start of the procedure the anesthetist should check that they have these “top offs” in their caddy.

Note: for castrations, as long as the patient was dosed appropriately, and the cord and skin were blocked well, it should not be necessary to “top off” the patient.

NOTE: All anesthesia “top offs” must have an 18 gauge 1 ½” needle on them. If you are doing equine work you must check the needle on all toppers and ensure that they are appropriate.

Determining if the Patient is Adequately Anesthetized for Surgery

<table>
<thead>
<tr>
<th>READING ANESTHETIC DEPTH</th>
<th>ADEQUATE/DEEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nystagmus present</td>
<td>No nystagmus</td>
</tr>
<tr>
<td>Central</td>
<td>Eye position rostral</td>
</tr>
<tr>
<td>Lacrimation, (tearing)</td>
<td>Less moist (eye should remain moist)</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>Muscle relaxation</td>
</tr>
<tr>
<td>Vocalization</td>
<td>None</td>
</tr>
<tr>
<td>Movement</td>
<td>None</td>
</tr>
<tr>
<td>Strong palpebral reflex</td>
<td>Reduced palpebral reflex</td>
</tr>
<tr>
<td>Frequent spontaneous blink</td>
<td>No or occasional spontaneous blink</td>
</tr>
<tr>
<td>Change in respiratory pattern, rate, and or depth indicates a change in plane and is considered by some to be the most reliable sign.</td>
<td></td>
</tr>
</tbody>
</table>

Note: The table above refers to patients anesthetized with the basic xylaxine-butorphanol, ketamine-valium protocol.

Once the patient is recumbent with a pillow under the head and a towel over the eye, check for depth of anesthesia:

If the patient is recumbent but seems light immediately after induction (nystagmus, tearing/lacrimation, muscle tone):

• Wait 2 minutes and check depth again.
• Administer a top off if
  • If horse does not completely relax (the upper leg does not move to the ground.
  • If nystagmus has not slowed
• If patient has relaxed and or nystagmus has slowed, wait another minute and re-asses.

Determining When to Administer More Anesthetic Drugs During the Procedure
Many factors will affect your decision to top off your patient during the procedure. They will include all of the factors you considered when choosing a protocol, but will also include what point in the procedure the surgeon is at. For a routine castration if the procedure is moving along as it should, the patient should not require a top off. Inexperienced anesthetists frequently top off patients unnecessarily. Consider the following

- If the patient stretches its' hind legs during the first crush, this does not necessarily warrant a top off.
  - This may be an unconscious reflex.
  - If the team is working efficiently, the block will not have taken effect. By the time the second testis is crushed it will have.
  - You will lower the patients’ leg between crushes / after the second crush. During this time there is little to no stimulation, and most patients will become deeper, without the addition of anesthetics.

- If the patient stretches its' hind legs during the second crush
  - You will lower the patients’ leg after the crush. During this time there is little to no stimulation, and most patients will become deeper, without the addition of anesthetics
  - The procedure is basically over, and the drugs administered will not affect the procedure, they will only cause recovery to be delayed.

**Recovery**

- Pull the down forelimb forward to prevent the radial nerve from “falling asleep” (this results in a recovery where it may appear to onlookers that the patient has broken a leg).
- The majority of our patients will recover without incident or assistance.
- If working in an enclosed area (arena) and anesthesia was smooth and appropriate, with a single or no top off, the patient should be left without stimulation to recover. The towel should be left in place over the patient’s eye to reduce stimulation.
- Occasionally, a patient will try to rise while it still has nystagmus.
  - a. The anesthetist should prevent the horse from rising by holding the head so that the nose is elevated approximately 90 degrees to the ground, until the nystagmus stops.
  - b. Before attempting to keep a horse down by holding the head, have an experienced handler demonstrate the technique.

- In the event that the patient needs assistance,
  - a. Avoid using the lead rope or head to provide it. This tends to make the patient more unbalanced. Instead
  - b. Pull back on the tail as the horse rises to allow him to steady himself.
  - c. With mustangs or completely untrained animals it is better to allow them to stand without assistance, as their instinct is to bolt when the feel restraint. This can result in the horse falling.

- The horse is allowed to stand for 10-15 minutes before being moved or transported.
  - a. This will depend on the length of anesthesia.
  - b. At times, with patients who where behaviorally challenging, it is safer for all involved to load the patient into the trailer as soon as they have risen. This is often the case with animals who were sedated in the trailer, prior to unloading.
Improving the Quality of Recovery for Your More Challenging Patients

- For patients who did not ever get quite deep enough, or who fought induction (did not go down well)
  a. Finish with a xylazine dose of 20% of the initial premed dose.
  b. Do not disturb the patient after this.

- For longer surgeries or if your patient received multiple top offs,
  a. Finish with xylazine dose of 20-30% your initial premed dose.
  b. Pull the down forelimb forward.
  c. Do not disturb the patient after this.

- For patients who received IM sedation prior to surgery,
  a. Finish with a xylazine dose of 30 to 35% of the initial premed dose.
  b. Wait 20 minutes, roll the patient, pull the down forelimb forward.
  c. One hour after the last ketamine, administer alpha 2 reversal. (Tolazine or Yohimbine; We use $\frac{2}{3}$ the label dose and administer over a 3 minutes)
  d. Allow the patient to recover unassisted.

Anesthetic Maintenance Protocols

<table>
<thead>
<tr>
<th>Weight in kgs</th>
<th>Weight in lbs</th>
<th>XYLAZINE 2.1 mg/kg/hr mg</th>
<th>XYLAZINE 2.1 mg/kg/hr ml</th>
<th>KETAMINE 7.2 mg/kg/hr mg</th>
<th>KETAMINE 7.2 mg/kg/hr ml</th>
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<tbody>
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<td>50</td>
<td>110</td>
<td>105</td>
<td>1</td>
<td>360</td>
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<tr>
<td>75</td>
<td>165</td>
<td>160</td>
<td>1.6</td>
<td>540</td>
<td>5.4</td>
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<td>210</td>
<td>2.1</td>
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<td>315</td>
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<td>990</td>
<td>950</td>
<td>9.5</td>
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<td>1370</td>
<td>13.7</td>
<td>4680</td>
<td>47.0</td>
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TRIPLE DRIP
For Anesthetic Maintenance

<table>
<thead>
<tr>
<th>kg</th>
<th>lb</th>
<th>Maintenance ml/hr</th>
<th>Maintenance</th>
<th>10 d/ml admin set</th>
<th>Maintenance</th>
<th>15 d/ml admin set</th>
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<tbody>
<tr>
<td>50</td>
<td>110</td>
<td>110</td>
<td>~ (&lt;) 1 drop every 3 seconds (120 ml)</td>
<td>~ (&lt;) 1 drop every 2 seconds (120 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>220</td>
<td>220</td>
<td>~ (&gt; ) 1 drop every 2 seconds (180 ml)</td>
<td>~ (&lt;) 1 drop every second (240 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>330</td>
<td>330</td>
<td>~ (&lt;) 1 drop every second (360 ml)</td>
<td>~ 2 drops every 3 seconds (360 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>440</td>
<td>440</td>
<td>~ 3 drops every 2 seconds</td>
<td>~ 5 drops every 2 seconds (600 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>550</td>
<td>550</td>
<td>~ (&gt; ) 2 drops per second (720 ml)</td>
<td>~ (&lt;) 3 drops every second (720 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>660</td>
<td>660</td>
<td>~ (&lt;) 2 drops per second (720 ml)</td>
<td>~ (&lt;) 3 drops every second (720 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>350</td>
<td>770</td>
<td>770</td>
<td>~ (&gt; ) 2 drops per second (720 ml)</td>
<td>~ (&gt; ) 3 drops every second (720 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>880</td>
<td>880</td>
<td>~ 5 drops every 2 seconds</td>
<td>~ (&gt; ) 4 drops every second (960 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>450</td>
<td>990</td>
<td>990</td>
<td>~ (&lt;) 3 drops every second (1080 ml)</td>
<td>~ (&gt; ) 4 drops every second (960 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>1100</td>
<td>1100</td>
<td>~ 3 drops every second (1080 ml)</td>
<td>~ 9 drops every 2 seconds (1080 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>550</td>
<td>1210</td>
<td>1210</td>
<td>~ (&gt; ) 3 drops every second (1080 ml)</td>
<td>~ 5 drops every second (1200 ml)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>1320</td>
<td>1320</td>
<td>~ (&lt;) 4 drops every second (1440 ml)</td>
<td>11 drops every 2 seconds (1320 ml)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Patient should have (100-150 mg/kg of GG will cause recumbency)
- Brisk palpebral,
- Occasional nystagmus,
- Wet eye.

The equivalent of one 3 ml topper is delivered in 100 ml

METHODS OF GAINING ACCESS TO THE INTRACTABLE PATIENT

1. Pinning the Patient
2. Using a chute
3. Roping the patient from horseback and keeping the roping horse between you and the patient.

Methods for pinning the patient

Use of a quiet, well broke horse to pin a horse.

Two haltered horses, one well broke (in front) and one unwilling to be sedated (behind), standing against a wall or fence. In most instances the difficult patient will stand calmly if the anesthetist works quietly. Simply:
- reach under the neck of the quiet horse,
- place your needle (bury it in one smooth motion),
- release the needle and wait for the patient to react
- administer sedation
The use of a fence and pipe panels to pin a horse:

These can both be done with one or two horses. Being herd animals, they will always be easier to deal with if there are two.

In both cases above, the panel or panels are tied shut with a quick release knot. Once the patient is adequately sedated, the induction dose is administered, the rope is released, and the panel is swung open. Someone on the other side of the fence works to motivate the horse to move away from the fence after it is successfully sedated or anesthesia is administered. This can be accomplished with a rope, a hat or simply by "whooping" the patient away from the fence, (or out of the chute). Remember to use only enough “motivation” to move the patient an adequate distance from the panels or the chute.
Important Points
1. Even if you can halt the horse pinned with a panel or in a chute, do not attempt to pull it away from the fence or chute. If you had to pin a patient to sedate and induce it, its behavior during induction may be unpredictable. These patients are dangerous until they are fully anesthetized.
2. A horse’s natural instinct when something pulls on its head is to pull back and this will cause them to fight both you and the induction process. It is better to motivate the patient to move by becoming a temporary predator and herding.

Use of a Chute

Once the patient is in the chute with a rope around its neck, a twist is placed in the rope between the patient and the bars. This is followed by a multiple twists in the rope between the operator and the bars.

Two placement methods for the neck rope;
1. Drop a loop in front of head, slip back against neck
2. Drop the end of the rope down next to the neck (far side) and use a hook to retrieve the end.

Finish both by;
3. Twist between patient and bars of chute
4. Pull through the bars
5. Multiple twist between operator and bars of chute
6. Administer sedation (you may opt to place a blindfold)

After the patient has become adequately sedate to induce;
7. Quietly loosen your neck rope and move it to the head.
8. Place it under the patients Jaw or mandible and use it to support the patients head. This will allow you to maintain a taught enough vein that venipuncture is still possible.

**Important Points**

Remember, when working with a pinned patient or a patient in the chute;
- Prior to administration of your induction dose make sure that someone is ready to let the patient out.
- If using bucking chutes, this person should stand quietly to the side of the chute until signaled to open it.
- When the gate is opened the gate person should step back as they open the gate to ensure that the gate cannot hit them, and the horse cannot run over them.
- At times the space you are working in may become too congested to allow for the safety of your team and patients. If the area close to the chute/s has become congested and the area away from the chute/s is clear, the following method can allow you to move the patient farther from the chute prior to induction.
  - Administer your sedation dose.
  - Wait until the patient starts to become sedate, but do not wait until they are profoundly sedate
  - Add 20% of your initial Xylazine dose to your induction syringe.
  - Administer this (again, a little earlier than you would normally)
  - Open the gate and run the patient out. You will need to be more serious in your attempt to run them away from the chutes. These patients will move further from the chutes prior to dropping. If you do not use adequate ketamine, or you administer the induction dose too prematurely, your patient will not become anesthetized.

**REMEmBER; never** rush or jump on a horse if it has not become laterally recumbent in an attempt to pull it down.
- This will cause the patient to fight the anesthesia process. If the patient fails to become fully anesthetized you, your support staff, and your patient are better off if you simply run the patient back through the chute and start over. Remember to increase your dosing if this occurs.
- Performing a castration on a horse who has not relaxed, will increase the chances of straining during the procedure and evisceration after the procedure.

**Caution should always be used when working in the field, and no procedure should be attempted or performed without thoroughly evaluating/considering the possible negative outcomes of your actions and how these can be handled. Your reputation is everything in these communities and the safety of your team and your patient should always be your first priority.**

Anesthetic protocols used for range of use table etc… can be found in the following publications;
SURGICAL FIELD WORK WITH R-VETS

Required Preparation

We expect all participants of the clinic to have prepared. This includes:

1. Read the chapter on equine castration in Turner and McIlwraith “Techniques in Large Animal Surgery”.

2. Practiced the modified millers knot.

3. Memorize the steps to a routine castration listed below. You should say these steps, out loud or in your head, as you castrate each horse. This will help to ensure that you do not forget any step in the process (this tends to happen after you start to get comfortable with the process)

Steps to a Routine Castration

☐ Identify two Testi
☐ Block Cord (or Testi)
☐ Block Skin
☐ Identify median raphe
☐ Make 2 incisions ½" on either side of the median Raphe, at the bottom of the scrotum
☐ Expose the Down testis
☐ Strip the cord
☐ Place the emasculators
   ☐ Perpendicular to the cord
   ☐ Parallel to the patient
   ☐ Handles Facing toward the rear
☐ Check that the ratchet lock is open
☐ Close the emasculators just until they grab
☐ Check for skin caught in emasculator jaws
☐ Close emasculators COMPLETELY in one smooth motion
☐ Expose the up testis
☐ Strip the cord
☐ Place the emasculators
   ☐ Perpendicular to the cord
   ☐ Parallel to the patient
   ☐ Handles Facing toward the rear
☐ Check that the ratchet lock is open
☐ Close the emasculators just until they grab
☐ Check for skin
☐ Close emasculators COMPLETELY in one smooth motion
☐ Stretch incision
☐ Remove the down emasculator
   Perpendicular to the cord
☐ Check For Bleeding
☐ Clean your patient

If you do not know the steps to a castration, should you be doing one?

- Work days tend to be long. Individual or group inefficiency and unpreparedness will lengthen the day. This results directly and indirectly in a loss of teaching time as there is
Less time to rest/recover
Less time to round – without rounds the learning experience is incomplete.

Keep in mind that the staff may be on the road for 2 months. Cumulative lost rest is a significant issue for us.

• DO NOT sit or chat if all equipment and supplies are not ready for the next procedure.

• Students will be assigned to a team. The team may rotate working with different doctors. You should communicate within and between teams so that everyone is ready and plays their own position. Maintain all necessary equipment and drugs so that they are easily available, clearly labeled, and easy to move (this is particularly important in an emergency, and you never know what you will need). DO NOT carry supplies in pockets (they will fall out when you bend over) or in an arm load (you will drop them). We have caddies, buckets, bucket buddies, and toolboxes for this purpose. Blades, needles and syringes must be put in the caddy immediately after use to avoid their getting lost. Start and stay prepared. Each evening the group is expected to prepare for the following day. Volunteers are responsible for adequately preparing for the day’s work. Check that there are sufficient:

- Forms
- Vaccines--tetanus antitoxin, tetanus, and rabies
- Cooler/Ice packs
- Sterile surgical gloves
- Garbage bags
- Buckets
- Sharps containers
- Caddies
- The equine surgery box-fully stocked
- The equine foot box
- Banamine
- Drinking water
- PPG
- Insect repellent Insect repellant
- ♦ Sun block
- ♦ Equine anesthesia pillows
- Syringes
- Needles
- Blades
- Buckets
- Caddies
- Carbocaine
- Banamine
- PPG
- Snacks/lunch
- Equine pharmacy
- Filled carboys, collapsible water jugs or buckets lined with garbage bags, twisted shut above the water level

The Surgery (Anesthesia is discussed in another section)

• All team members should be prepared to perform their assigned tasks prior to the patient becoming recumbent. You should know your task for the current procedure, (and for the next one). Always look ahead!
• Stay prepared.
Once the patient is recumbent and adequately anesthetized the rest of team should move quickly to complete their assigned task/tasks as efficiently as possible.

- Do not rush the patient. Wait until they are fully relaxed to proceed. The upper leg should be resting on the ground.
- Everyone involved in the process must remain on the horses back side, which is the side away from the hooves.
- The exception to this is if you are doing a procedure involving the leg or foot.

Prior to the patient becoming recumbent each team member should check that all supplies are ready for the patient. Each member of the team has an assigned task (refer to your note cards).

NOTE: Each time you reach into the vaccine cooler, feel the icepacks. Vaccine must not be allowed to become warm. If the icepacks are not frozen, replace them immediately.

**Support Team**

1. **Tie the leg.**
   
   To provide the maximum exposure for students; (patient positioned on left side)
   
   - Stand behind the patient. Raise the upper leg (the patient’s right leg)
   - Stand so that you are in contact with the leg so that if the patient moves you will be pushed, not kicked
   - Place the noose around the pastern.
   - Figure eight twice around the hock ending at the pastern.
   - Place a half hitch at the pastern.
   - Step back from the patient
   - Pass the rope behind yourself.
   - Sit back on the rope, allowing your weight to do the work
   - **DO NOT TIE THE ROPE AROUND YOURSELF.**
   - The rope should lie smooth and flat on the leg.
   - A ¾ “rope of adequate length (15-20 feet) is the rope of choice for adult horses.
   - A 5/8” rope 12-15 feet long is more suitable for minis, ponies, foals and/or burros.

2. **Scrub**
   
   - Place bucket behind patients’ leg. The bucket should contain
     - 1/3 to ½ full of water
     - Disinfectant
       - Strong tea colored if using betadine
       - 3 ounces per gallon if using nolvasan
       - Practical/ pound cotton torn
       - Spray or squeeze bottle of scrub floating in the bucket
     - **ALWAYS RETURN SCRUB TO BUCKET, NEVER SET DOWN ON GROUND.**
   - Place your body against the inside of the leg so that the foot is beside your head
   - Squirt or spray the scrotum with scrub.
• Remove a handful of cotton from the bucket, squeeze \( \frac{1}{2} \) of the water from it, and scrub the scrotum thoroughly.
• For hernias or cryptorchids use a prep sponge.
• **DO NOT PLACE USED SPONGES INTO THE CLEAN WATER BUCKET.**
• Rinse with clean water from the prep bucket.

3. Block

To increase exposure, minimize stimulation caused by manipulating the testis and stripping the cord, and paralyze the cremaster and tunic muscles. Increased exposure is also useful in the case of post operative bleeding.

• Use a 35 cc syringe filled with block (cabocaine or lidocaine), and an 18 gauge needle.
• Inject 10 mls block into the each spermatic cord. Isolate and grasp the spermatic cord firmly. Insert the needle where the cord rolls over your thumb and index finger, aspirate to insure you’re not in a vessel, and inject 10 ml carbocaine into each cord. To work your needle MUST be in the cord. The block will not migrate across the tunic.

or;

• Inject directly into the center of each testis until you feel them become turgid (full). This is easier to learn, but takes more time and anesthetic, as it must migrate up the cord. If the team is efficient, the castration may be completed before the anesthetic has taken effect.

and

• Slide the needle under the skin and inject 5-7 mls of block where you plan to incise.

• Replace the needle on the carbocaine syringe and refill. **NEVER SET A SYRINGE DOWN WITHOUT A NEEDLE!!** Once you do the syringe must be considered contaminated and discarded. Do not remove the needle unless you are holding the replacement needle and are ready to place it.

**NOTE:** Maintain correct body position as the testis is injected. Always remain in contact with the patient’s leg

At this point the surgeon can begin. The support team will continue as indicated below.

4. Check the record. If necessary, using your note cards, assess and record;
• BCS
• Age
• Patient description

5. Administer and record
• Vaccines
• flunixin
• PPG (if you are really efficient, you can administer this during the prep. Otherwise, wait until the emasculators are on and the leg rope is released.
• Antitoxin (ONLY IF INDICATED BY PATIENT HISTORY)
• Always verify what is in the syringe prior to administration. Do not administer any drug if you do not fully understand what its function is, and how much the patient should receive.
Supply bucket behind leg and within reach of the surgeon.

NOTE: All team members should be familiar with all tasks and supplies necessary to complete the castration process. Never stand idle if all equipment and supplies are not ready for the next patient.

**Surgeon**

1. Prepare for surgery prior to the patient becoming recumbent. Check that you have;
   a. Surgery bucket filled 1/3 to ½ way with water and nolvasan or betadine
   b. Gloves
   c. Blade
   d. Suture (always be prepared to ligate. Don’t open the suture, someone can pass it to you, but verify that it is available)
   e. Emasculators
   f. Needle drivers
   g. Scissors
   h. Large clamp (Ochsner or bronchial clamp)

2. Position your equipment behind the patient’s leg, within your reach.

3. Incise
   a. Squat or kneel (on one knee) behind the patient
   b. Place your shoulder against the inside of the patient’s leg
   c. Identify two testi (NEVER INCISE IF YOU HAVE NOT DONE SO)
   d. Use your non dominant hand to stretch the skin taught
      • If the testi are large, place your hand in front of the testi and push them back into the scrotum.
      • If your hand is too small to manage both, do one at a time.
      • If testi are small, simply spread the skin taught over the testi
   e. Identify the median raphe
   f. Make two incisions ~ 1 inch apart on either side of the median raphe.
      The incision should be;
      • Made through all layers in a single pass
      • Long enough to expose the testis
      • At the lowest point on the scrotum
      • Parallel to one another

4. Exteriorize the testis
   a. Start with the down testis.
   b. “Pop” it through the incision as if you were popping a grape out of its skin
   c. Secure the testis
      • Make a ½ inch incision at the proximal end (nearest the cord) to use as a finger hold or
      • Place a clamp (we use a bronchial clamp. A towel clamp is also effective)

5. Strip
   a. Hold the testis in your non dominant hand
b. With your dominant hand grasp the cord firmly and stroke.
c. Initially it will feel as if you are not affecting the fascia.
d. Continue stroking and it will fall away all at once.

6. Emasculate
   a. Face the nuts of the emasculator up (nut to nut)
   b. Open the emasculator jaws
   c. Check that the ratchet is open
   d. Place the jaw around the cord with the handles
      - facing to the back of the horse
      - Parallel to the patient’s body
      - Perpendicular to the cord
   e. Close the handles only until they just begin to “bite” the cord
   f. Lie the testis down. This release of all tension on the cord improves the quality of the crush
   g. Using both hands, close the emasculators smoothly and completely
   h. Check the ratchet is locked

7. Stretch the incision
   a. Place your index fingers or thumbs in the front and back of the incision
   b. Stretch the incision until you feel it tear. You must mean this when you do it.

8. Repeat the process on the up testis.

9. Reduce the tension on the leg rope and
   a. Allow the leg to drop almost to the lower limb. Allowing the leg to drop to the ground may inadvertently release the leg from the rope.
   b. Wait
      - One minute per year of age
      - Longer is better

10. Remove the emasculators
    a. Raise the leg
    b. Open the emasculators
       - Perpendicular to the cord
       - Parallel to the body

11. Check for bleeding as the cord slips back into the patient.

12. Trim any tissue that will hang down from the incision after the patient stands up

13. Clean the scrotum

14. Remove the leg rope

15. Pull the down forelimb forward. This will prevent the radial nerve from falling asleep

16. Pick up gauze etc

17. Check the record
18. Prepare for the next patient

**Splitting the Cord**

At times the size of the cord will necessitate emasculating it in two crushes. This method provides a better crush and requires less hand strength, as the tunic is removed separately. The emasculators do not need to be in place for much time, as the quality of the crush is much higher.

Follow the steps for a routine castration. Once the cord has been stripped:

1. Using a pair of blunt tipped scissors, extend the hole you created for your finger hold as far down the cord as your scissors can easily reach.
2. Place a clamp on the tunic to prevent losing control of it. If lost, the retained tunic can become the focus of a scirrus cord.
3. Use your thumb to puncture a hole through the mesorchian to create two separate portions of the cord;
   a. the vessels
   b. the cremaster muscle and tunic
4. Crush the vessels as described in the routine castration. The emasculators do not need to be left on for as long as there is less tissue in the crush, which results in a better crush. The vessels in the photo below were ligated prior to placement of the emasculators.
5. Crush the tunic and cremaster. The tunic and cremaster were ligated in the photos below prior to placement of the emasculators.
6. Repeat the process on the second testis
7. Complete the castration process as described for the routine castration.
Removing the Median Raphe

1. Apply traction the median raphe using your non dominant hand.
2. Avoid any large vessels.
3. Excise the raphe as shown, using a pair of scissors.
UNDERSTANDING THE CRYPTORCHID

This section is designed to make the procedure of castration and cryptorchidectomy easier to understand. Some oversimplification of the embryology of the testis and the assumption that readers are familiar with anatomical and developmental terminology is required for brevity. The following is not intended to be a detailed discussion of the embryology of male development in the horse, but a simplified version pointing out some important factors in the surgical anatomy of cryptorchid castrations.

For more detailed information, please refer to the selected bibliography at the end of this section.

Anatomy and Anatomical Terminology

The word “cryptorchid” is used to describe any testis that is not in the scrotum. There are three types of cryptorchids.

1. Inguinal
2. Abdominal
3. Incomplete

In the normal juvenile or adult male horse the testis is found in the scrotum. A peritoneal process, the “vaginal tunic” (or just “the tunic”) passes through the inguinal canal and surrounds the blood and nerve supply to the testis, as well as the vas deferens, and surrounds testis and epididymis in the scrotum. (The blood vessels are branches of the testicular artery and vein, which leave the caudal aorta and vena cava in the dorsal lumbar region, near the kidneys.) The inguinal canal in the horse is relatively longer than in other species and runs between a deep and a superficial hole in the body wall. These are called the “internal inguinal ring” and the “external inguinal ring”, respectively. The external inguinal ring is larger than the internal inguinal ring and is palpable in the groin region, especially with the horse in dorsal recumbency. The internal inguinal ring is smaller and is not palpable from outside the abdomen. The “vaginal ring” is the peritoneal lining of the internal inguinal ring. The “vaginal process” is a conical piece of the peritoneal lining that is attached to the tail of the epididymis by the ligament of the tail of the epididymis and will become the “vaginal tunic” once the epididymis and testis pass through the inguinal canal and exit the abdomen.

Testicular Development and Descent in the Equine Fetus (very simplified!)

The left and right testes each differentiate on the dorsal body wall from the corresponding Wolffian or mesonephric duct next to the primordial kidneys (mesonephros) in the first 5 ½ weeks of fetal development. At this time a chord of mesenchyme, called the “gubernaculum” runs from the caudal pole of the testis and the developing tail of the epididymis to the caudo-ventral body wall. This structure will differentiate into the ligament of the tail of the
epididymis, and the vaginal ring itself. These structures are critical in finding and delivering a cryptorchid testis in surgery. Between 5 and 8 months of pregnancy the testes lay right next to the developing vaginal ring (to which it is attached by the gubernaculum) and become quite large. In fact, during this period the intra-abdominal fetal testis is as large as that of a full-grown stallion. This increase in size occurs by adding cells inside of the testis and causes the bottom of the organ to approach the internal inguinal ring while the top of the testis remains in contact with the dorsal abdominal wall.

Prior to birth, the testes begin to shrink. As they shrink, they pull away from the kidney, while they remain very close to the inguinal canal. Just as they added cells to grow in size, they lose cells to shrink. This process leaves each testis somewhat soft and pliable, which allows it to slip through the internal inguinal ring (vaginal ring) and into the inguinal canal.

Normally, the testis slips into the inguinal canal during a brief period prior to parturition when the internal inguinal ring is widest in its development. During this limited amount of time the testis must shrink enough to pass through the ring. If not one could think of it as having “lost the chance” to enter the canal and is, therefore, “trapped” in the abdomen. In this case the testis will never leave the abdomen unless it is removed surgically. On the other hand, if the testes are able to slip into the inguinal canal during this time frame (and most of them do) they will eventually migrate subcutaneously to the scrotum (although they may remain in the inguinal canal for some period of time after birth). The vast majority do become scrotal testes, and are removed by routine castration technique. Those that remain in the inguinal canal or do not quite make it to the scrotum will often arrive in the scrotum as the horse matures and the testes enlarge. Horsemen refer to this as the testis “descending,” or “dropping.” The colloquial term for a horse with a testis hidden in the inguinal canal or under the skin outside the scrotum is a “high flanker”.

Testis at its Largest

Testis after Shrinking

Testis Entering the Canal
If the testis does NOT enter the canal (remains in the abdomen), it is most often found just inside the internal inguinal ring. At times the tail of the epididymis enters the inguinal canal unaccompanied by the testis. This is referred to as an “incomplete” cryptorchid. On very rare occasions a testis will remain in the dorsal or caudal abdomen, anywhere from the origin of the testicular arteries and veins in the lumbar region, along the normal pattern of decent in the fetus, to near the internal inguinal ring.
Inguinal Cryptorchids and “High Flankers”
In younger horses with small testes, the cremaster muscle can pull the testis into the external inguinal ring and “hide” it inside the inguinal canal. For this reason, some prefer to wait until horses are older than a year for castration. However, horses cannot pull a testis through the internal inguinal canal and into the abdomen. Inguinal and subcutaneous testes are actually easy to find using good anesthesia technique, patient positioning, and anatomical knowledge.
The inguinal cryptorchid is the most common presentation and is no more difficult to castrate than a normal testis. Push your hand firmly into the ring. If the testis is in the inguinal canal, it will be expelled superficially and appear as a smooth movable structure under the loose skin between the external inguinal ring and the scrotum.

To find an inguinal or subcutaneous testis:
1. Put the horse into dorsal or semi-dorsal recumbency.
2. Find the easily palpable external inguinal ring in the groin region of the patient. It will be a 3-4 inch slit running in and parallel to the crease between the abdominal wall and the inside of thigh (see figure).
3. Put firm downward pressure into the inguinal canal. If the testis is in the canal it will slide into the subcutaneous space and be readily palpable. Feeling along a line between the external ring and the scrotum will identify subcutaneous testes, as well. Unlike superficial inguinal lymph nodes and fat, a testis is oblong, smooth, and “slippery”.
4. If the testis can be manipulated into the scrotum, the castration proceeds by the normal protocol. If the testis cannot be moved to the scrotum, an incision is made over the testis (or over the inguinal canal) and the testis is emasculated as it would be in a routine castration.

Abdominal Cryptorchids
Both the abdominal and incomplete cryptorchid are more difficult cases to handle. Remember: the abdominal cryptorchid testis is ALMOST always found just inside the internal inguinal ring. This is as one would expect from the development and decent of the testis discussed above. Therefore, in the majority of cases the testis can be pulled through the internal inguinal ring and the inguinal canal with a little firm, gentle traction. In the extremely rare instance that the cryptorchid testis is not next to the internal inguinal ring, it may be found at any point along the path followed during normal decent between the lumbar dorsal body wall and the internal inguinal ring.

The Surgical Approach to an Abdominal Cryptorchid Testis
There area a variety of techniques to finding and removing an abdominal testis in the horse. The following approach has proven effective and safe for field cryptorchid castrations and will be discussed in a series of sequential steps. To be successful, a grasp of the anatomical and developmental aspects of the testis and surrounding structures is essential. Once it has been established that the testis is not in the scrotum, the inguinal canal, or under the skin between these two structures, proceed as follows:
1. Establish that the horse is at an adequate plain of anesthesia to allow it to be placed in dorsal recumbency and that it is adequately relaxed. This may require additional xylazine, ketamine,
2. Roll the horse into dorsal recumbency and untie the hind legs. If the rear legs are flexed with a rope it will be much more difficult to visualize the external inguinal ring. The horse can be stabilized by a handler supporting each forelimb at the shoulder. A large pad for the horse’s head and some attention to the rockiness of the ground will prevent pressure injuries to the patient.

3. Place bags, towels, or aluminum foil over the horse’s hind feet to prevent dirt from dropping into the surgical field.

4. Do a good surgical prep over the entire inguinal area, including the medial sides of the thighs and from the pubis to the end of the sheath. Place a dry towel or cotton in the sheath to keep the penis out of the way and absorb leaked urine.

5. Draping in the triangular pattern shown is highly desirable, as there will be instances when it may be necessary to enter the abdominal cavity.

6. Surgeon and assistant must scrub their hands and wear gloves. Sterile sleeves for the surgeon will also allow entry into the abdomen in the rare instances where that is necessary.

7. The surgeon kneels directly behind the patient with the assistant in front of the leg on the side to be explored.

8. Palpate the external inguinal ring as above, just to be sure that the testis is not inguinal and to identify the incision site.

9. Make an incision directly over the external inguinal ring and parallel to it. The incision should be about 1½ times the length of the palpable slit that is the external ring and should be extended no deeper than the dermis. The remaining dissection to find the external inguinal ring is done bluntly with the fingers. Injury to large vessels in this region will make visualization very difficult. As the external inguinal ring is dissected out, the assistant uses fingers or retractors to open the incision and allow visualization. A large self-retaining retractor can be used, but is less adaptable than an assistant.
10. The loose areolar connective tissue is bluntly dissected until the white, fibrous external inguinal ring is exposed. A white finger-like projection coming up from the interior of the ring indicates an incomplete cryptorchid covered by the vaginal process. If this is the case, the white membrane (vaginal process) is opened with scissors and the epididymis is pulled into the incision and used as a handle to deliver the testis from the abdomen, as described below.

11. More commonly, a group of very thin vessels will be seen going from the surrounding fascia, over the edge of the external inguinal ring and down into the inguinal canal. These vessels may fan out along the entire length of the canal or be in a more discrete bundle. They indicate the tissue that would become the scrotal ligament in a normally descended testis. They should be grasped together, making a bundle.

12. Carefully place traction on the bundled vessels (scrotal ligament) to evert the vaginal process through the internal inguinal ring (vaginal ring) and into the inguinal canal. The vaginal process is conical and the tip can be visualized as a small white structure as it passes out of the external inguinal ring. Palpation with an index finger during traction, will establish that the base of the cone is deep inside the inguinal canal. This structure will be more or less easy to mobilize in different horses.

13. Once the vaginal process is identified, it is opened with scissors or the point of a scalpel. Immediately inside the tip of the vaginal process is the ligament of the tail of the epididymis (remnant of the embryonic gubernaculum). This structure is grasped and used to deliver the epididymis through the inguinal canal and into the incision. Firm pressure is required to do this, but it is important not to break and lose the ligament or the epididymis.
14. Using the epididymal structures as a guide and handle traction in placed on the abdominal testis. The object is to deliver the testis through the smallest hole in the vaginal process and without disrupting the internal inguinal ring. A combination of traction, massage with an index finger, and occasionally stretching the vaginal process will deliver nearly every testis, with some patience.

15. Once the testis appears through the external inguinal ring, its vessels are ligated as one unit with 2 or 3 Vicryl and cut, along with the vas deferens. The cryptorchid testis and the epididymis are removed and the contralateral testis is castrated.

16. If only minor stretching of the vaginal process is required to remove the cryptorchid testis and the internal inguinal ring was not invaded, the incision is left open to heal by second intention and no further suturing is required. If the testis was larger and more difficult to deliver the inguinal canal can be closed with 2 or 3 Vicryl, by placing one or a few cruciate or simple interrupted stitches across the inguinal canal.

17. Because the inguinal canal in the horse is long and runs up the body wall, the internal inguinal ring cannot be readily identified for suturing. So it is difficult to do a firm closure of the canal if the internal ring has been opened significantly. Further, any suturing in this area should be done with care, due to the large vessels that lay in the fascia around the inguinal canal. If there is concern about the integrity of the closure and possible evisceration, the incision should be tightly packed with a sterile towel and the skin closed in a simple continuous pattern, over the towel. Then in 48-72 hours the sutures and towel are removed. At this time swelling caused by the towel will have closed the canal and granulation has started. This generally requires a second, though brief, anesthesia.

18. IF the vessels indicating the scrotal ligament cannot be identified; IF the landmarks are broken while attempting to exert traction; or IF the testis is too large to be delivered through the internal inguinal ring: a parainguinal incision can be made, allowing the surgeon to enter the abdomen through a very small incision just next to the inguinal canal.

19. To utilize the parainguinal incision the assistant retracts the existing skin incision cranially and medially. In this region the internal abdominal oblique muscle is thin, but strong and fibrous. The surgeon selects a site a few inches medial and parallel to the external inguinal ring. A small stab incision is made just though the external muscle sheath. This is extended into the abdomen by using a blunt instrument, such as a the tip of Mayo scissors. The instrument is opened, stretching the...
incision so that the surgeon can stick two or three fingers into the abdomen.

20. Since the majority of abdominal testes are just next to the internal inguinal ring, the surgeon sweeps laterally and deep to the body wall incision, to palpate and grasp the testis, epididymis, or vas deferens and deliver the testis from the abdomen. The vessels are ligated and cut as above. Closure of the parainguinal incision with sutures in the internal abdominal oblique is a simple matter and very strong. No towel packing or removal is necessary. The skin incision is left open to heal by second intention.

21. In the rare instances in which the abdominal testis cannot be found via the small parainguinal incision described above, the surgeon simply extends the incision made bluntly in the abdominal wall, and, with a sterile sleeve, can explore the entire abdomen, following the decent of the testis from the dorsal body wall. Again, the incision, just large enough to permit the surgeon’s arm is easy to close, once the testis is found and removed.

Things Not to Do
- Start surgery before all anesthetic drugs and surgical supplies are immediately ready
- Start surgery before the horse is adequately anesthetized
- Sharply incise structures deep to the skin in the inguinal region. Injury to the large external pudendal veins in this region and their branches will result in extreme difficulty in visualizing structures.
- Attempt to find the landmarks around the inguinal canal without good light. Especially avoid having the sun shining in the surgeon’s eyes when working outdoors. A good bright headlamp is a big help.
- Inadequately dissect the fascia from the external inguinal ring. Visualization of the edges of the ring is essential for success. Make sure you can clearly see the ring and if that requires a longer skin incision, make a longer incision.
- Break the remnant of the scrotal ligament: it is the major landmark to the vaginal process. Using large curved Carmault forceps seems to be less traumatic than Ochsners or Kellys. Some surgeons use sponge forces.
- Disrupt the internal inguinal ring. This necessitates suturing the inguinal canal and packing the area with a sterile towel, which must be later removed in a second anesthesia.

A Few Last Points:
- IF the patient’s castration history is unclear and there is scar on the scrotum it may better to postpone the surgery until a serum testosterone or estrone sulfate (depending on the age of the horse) can determine if testicular tissue is present. If this is not possible or if the horse is known to be a hemicastrate, exploration of the inguinal canal as described above will either lead to the cryptorchid testis or it will yield the white fibrous stump of the chord from a removed testis, coming from the external ring into the subcutaneous tissues. Since in Quarter Horse
and Paint families an abdominal cryptorchid testis is more likely to be on the left side, it is sensible to approach the left inguinal region first. However, if a chord stump is found on the left side then the right inguinal canal is explored to find the testis.

- Always make sure that you can identify the testis, the head of the epididymis, and the tail of the epididymis before completing a castration. The most common cause of hemicastration (leaving an abdominal testis in the abdomen) is mistaking the tail of the epididymis for a small testis. If you can identify all three structures, you know that you have a complete castration.
- While with adequate sterile technique primary closure of inguinal incisions is possible, the issues of positioning, anesthesia, follow-up, and unrecognized breaks in asepsis make healing an open incision a good alternative in the field. These incisions, even with blunt dissection, seem to heal as rapidly as standard scrotal castrations.
- Remember: have a clear plan and everything AT YOUR FINGERTIPS before you consider starting surgery. This is no time to go looking for equipment and always plan for the procedure being difficult! If you find that you are not ready, allow the horse to recover and plan the procedure for another day.
- Be realistic and prepared to stop the procedure and allow the horse to recover IF:
  - You cannot find the important landmarks at the external inguinal ring or you cannot deliver the testis through the inguinal canal and do not want to enter the abdomen
  - Light is poor or it is getting dark
  - There a serious break in asepsis (i.e., mud falling into the incision)
  - Weather has changed: wind, dust, rain
  - The horse is not well anesthetized. This can often happen if an adequate plan of anesthesia was not attained at the start due to inadequate dosage or because the patient was excessively excited. The novice should not attempt this procedure on untrained horses that require IM or oral detomidine to allow venipuncture.

At any point in the progression of the technique as described above, if the surgeon feels that they cannot successfully complete the procedure. It is far better to stop (given that the abdomen is closed) and allow the horse to recover. Castration is an elective procedure that can be rescheduled when conditions are better. While we cannot always predict complications: “First, do no harm”.

Selected Bibliography:
A REVIEW OF IMPORTANT SURGICAL POINTS

- Identify both testi before incising
- Verify that you have adequate exposure prior to emasculating
- Split larger cords to obtain a better crush and minimize bleeding
- Orient the emasculators correctly:
  - Nut to nut
  - Handles
    - Facing toward the patients tail
    - Perpendicular to the cord
    - Parallel to the body
- Close the emasculators only until they start to grab or bite the cord, then release all tension on the cord by setting the testis down.
- Verify that the ratchet at the end of the handles is open, allowing it to lock when closed.
- Verify that no skin is caught in the blades of the emasculators
- Close the emasculators completely in one smooth crush.
- Latch the ratchet.

FOLLOWING THESE STEPS WILL REDUCE THE NUMBER AND SEVERITY OF BLEEDING AND RELATED COMPLICATIONS
THE BASICS OF EQUINE DENTISTRY

As a rural practitioner, performing an oral exam and dentistry is a routine part of the job. Oral health in patients who do not receive routine veterinary care can have significant and sometimes catastrophic effects on their quality of life.

Before undertaking any discussion of equine dentistry, you must understand the nomenclature used to identify teeth. The chart below shows the numbers assigned to each tooth in the Traidan system. The system is simple and unambiguous.

For several reasons, it is important to be able to tell the owner the approximate age of the horse you are examining. They may have been given an inaccurate age when they purchased the animal. They may have found the animal. They may have given you an inaccurate age as a means of testing you. In all cases, it is a basic tool that you should master.

The eruption table and the table of incisor wear below will help you learn to do this. You will be

<table>
<thead>
<tr>
<th>Age</th>
<th>Incisors</th>
<th>Canine</th>
<th>Premolars</th>
<th>Molars</th>
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<td>01’s</td>
<td>02’s</td>
<td>03’s</td>
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<td>0-7 days</td>
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<td>4 ½ yrs</td>
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<td>*Erupt In Males</td>
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<td>6 yrs</td>
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<tr>
<td>Permanent Incisors</td>
<td>In general yelloer, larger, more rectangular, uppers (100’s, 200’s) with two distinct grooves on front service, lowers (300’s, 400’s) with a single groove</td>
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*canine teeth form in both males and females; however they are generally smaller in females and only erupt in about 30%.

Note that the first molars (the 09’s) are the oldest teeth (with an occlusal surface) in the horse’s mouth.
expected to utilize these tables to determine the ages on every patient we see.

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<thead>
<tr>
<th>INCISORS CHARACTERISTICS USED TO ESTIMATE THE AGE OF THE HORSE</th>
</tr>
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<tbody>
<tr>
<td>Occlusal surface features</td>
</tr>
<tr>
<td>----------------------------------------------------------------</td>
</tr>
<tr>
<td>Eruption</td>
</tr>
<tr>
<td>In Wear</td>
</tr>
<tr>
<td>Level</td>
</tr>
<tr>
<td>*Cup Gone</td>
</tr>
<tr>
<td>Dental Star Appears</td>
</tr>
<tr>
<td>&quot;Dental Star &quot;Appears*&quot;</td>
</tr>
<tr>
<td>&quot;Dental Star &quot;Disappears*&quot;</td>
</tr>
<tr>
<td>No Enamel Spot</td>
</tr>
<tr>
<td>Oval to round</td>
</tr>
<tr>
<td>Round</td>
</tr>
</tbody>
</table>

*disappearance of the cup as well as appearance/disappearance of Galvayne’ groove (as many as 50% of horses may not have this groove) are considered unreliable by some practitioners.

Profile of the Upper Corner Incisor (103 & 203)

<table>
<thead>
<tr>
<th>Wider than Height</th>
<th>5-9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Square</td>
<td>9-10</td>
</tr>
<tr>
<td>Taller than Width</td>
<td>10+</td>
</tr>
</tbody>
</table>

Dental wear (and its utility for aging) is affected by many factors including breed, conformation and diet (affects both tooth formation and tooth wear).

You must have a basic understanding of development, form, and function of the masticatory system in order to develop an understanding of equine dentistry.

Horses are meant to spend a large portion of their time eating low quality feed. The long periods of time spent grinding food causes a great deal of wear on their teeth. For this reason the horse’s teeth are very long, with a great deal of tooth below the gum line early in life. The tooth erupts at a constant rate until there is no tooth left to erupt.

On average horses lose about 2-3 mm of tooth annually to the grinding forces that occur when they chew. This is referred to as attrition. Factors that affect attrition...
include:

1. The complex chewing cycle (varies from horse to horse).

The 3 stages of chewing shown in these diagrams are:

- Opening Stoke (A-B)
- Closing Stroke (B-C)
- Power Stroke (C-D)

It has been suggested that some horses are one sided chewers, a condition that could significantly affect attrition patterns.

2. Feed type
   - Nutrition affects formation
   - Affects length of time chewed, affecting attrition

3. Confirmation of the dental arcades
   - The upper arcades consist of wider teeth that are set further apart than the lower arcades.
   - In addition, the upper arcades may be set slightly forward of the lower arcades.
   - This can have a significant effect on dental attrition, and is what causes points to occur on the outside of the upper arcade, and the inside of the lower arcade. There is no tooth to wear against these surfaces, and therefore grind them down.

Anatomy of the tooth.

- The tooth consists of multiple layers with different characteristics. The layers are;
  - Pulp
  - Cementum
  - Dentin
  - Enamel
• **Infandibulum**

- Cementum is a living tissue and is the most adaptable of the tooth layers. It is found in the infundibulum and covering the entire crown. It is worn from the occlusal surface after the tooth erupts. It is deposited to the crown below the gum line for the life of the tooth. It adds to the size and strength of the tooth and protects the enamel. The deciduous incisors appear whiter due to the relative lack of cementum compared to the permanent incisors.
- Enamel is the hardest component of the tooth but it is brittle. It is 98% mineral, essentially dead and has no ability to repair itself. There are three types
  a. Type 1, found on the inside edge of the enamel folds
  b. Type 2, found at the enamel to cement border
  c. Type 3, found in a very thin layer at the enamel to cement and enamel to dentin borders
  d. Upper check teeth have more type 1 than type 2
  e. Lower check teeth type 1 and 2 are essentially equal
  f. Incisors are almost solely type 2
- Dentin consists of 70% minerals and makes up the majority of the tooth. It is produced by odontoblasts and pulp. The process occurs as the tooth erupts, preventing the pulp from becoming exposed. There is primary and secondary dentin. Secondary dentin can be regular or irregular.
- The pulp maintains a relatively large blood supply. It lays down secondary dentin to close the pulp cavity as the tooth erupts. This narrows the pulp cavity and strengthens the tooth as it ages. The blood supply and ability to lay down secondary dentin allow younger horses to fight pulp infections and repair themselves. Horses younger than 7 or 8 have more brittle teeth due to the lower ratio of secondary dentin. Older horses, with a higher ratio of dentin, have much stronger teeth. Root formation is completed by the age of 2, however separate pulp channels may not be completely formed in the mandibular cheek teeth until the age of 5-6 years.
- In addition to the Cementum, Enamel, Pulp, and Dentin, incisor and upper cheek teeth (premolars and molars) have a structure called an "infundibulum". This is an infolding of the peripheral enamel in the center of the tooth, which is filled by varying amounts of cementum. The incisors each have an infundibulum (colloquially called a "cup") the cheek teeth each have 2 infundibula.

### Common Malocclusions

All of the following malocclusions if untreated will eventually prevent the patient from closing their mouth, leaving them unable to chew. These malocclusions normally occur bilaterally.

**Step Mouth**

Equine teeth wear to reflect the tooth opposite them. The loss of a tooth prevents the opposing tooth from undergoing the natural process of attrition, resulting in a “step mouth”.
Rostral and caudal hooks are caused by incomplete occlusal contact during mastication.

Ramps form at the back of the mouth on the lower arcade

Shear Mouth forms when the buccal surface on the lower arcades and the lingual surface on the upper arcades wear away. This condition requires both dental and dietary management, and will not be corrected in one visit. It might never be completely corrected.

Performing Dental Work

Most routine dental work can be done with hand floats, and without a speculum. Performing a complete oral exam requires a full mouth speculum, and power equipment is required to address many dental abnormalities. You must allow your patient to periodically rest their jaw when wearing a mouth speculum. Speculums should be closed after a maximum of 15 minutes.

Equipment

- Bucket of water with small amount of nolvasan
- 400 ml dose syringe to rinse mouth
- Light source
- Wedge speculum
- Full mouth speculum (We carry Huassmann or MacPherson type)
- Hand floats
- Power float
Note: never set the equipment down on the ground. Always place floats and syringe back into the bucket and power float on top of a table or the platform on the back of the bus.

As an equine practitioner, performing an oral exam will be a routine part of your job. You may as well develop a system for this now. A thorough exam involves more than looking into the oral cavity. Not all patients will allow you to touch their mouths without sedation, but as you develop some skill, you should be able to examine most patients without.

Before looking into the patient’s mouth;

- Look for/ask about signs of quidding (dropped feed)
- Check manure for feed that has not been well chewed.
- smell the patient’s breath
- check both nostrils for even air flow
- Ask the client about eating habits, problems eating or changes in weight, appetite, or feed preferences. At times you will want to observe the patient eating prior to administering sedation. Watch for
  - problems chewing
  - problems swallowing
  - dropping feed
- Look at/feel the patients head.
  - Look for asymmetry in the jaw, the sinuses and the sides of the face.
  - Palpate the joint (Temporomandibular joint or TMJ)
  - Feel the upper molars and premolars for;
    - Packed feed (may pack feed to keep sharp buccal points away from their cheeks while eating)
    - Sharp buccal points
      - You sometimes feel the points through the cheek
      - Your patient protest (pushing points into the cheek may hurt
    - Markedly uneven or missing teeth
- Percuss the sinuses. (Knock or tap and listen for tone differences from one side to the other)
  - They should be empty and sound hollow.
  - If filled they will thud, indicating a problem. (often related to oral health issues)
- Examine the lips inside and out
- Check lateral excursion (move the arcades against one another side to side)
- Check caudal rostral excursion (raise and lower the head and see how far the incisors move front to back in relation to one another
- If you found sharp buccal points during the exam, you may want to reduce these before you continue. Opening the mouth will push the points into the check, causing and the patient may object.

Check the oral cavity

Use caution when examining mouths
- Do not get bitten.
- remove watches or other jewelry before placing your hand in the mouth

- Rinse the mouth, particularly the area between the teeth and the cheek
- Face your patient into the sun
- Using your thumb, press up on the roof of the mouth in the inter-dental space
- Hold the tongue between the arcades. (They are less likely to close their mouth if it means biting their own tongue)
Use care when holding the tongue. To avoid damaging the hyoid apparatus, causing permanent neurologic symptoms, you must brace your hand against the patient and move with them when holding the tongue. If you cannot maintain this contact with the patient's jaw release the tongue.

- Check for
  - ulcers
  - packed feed
  - sharp points on the outside of the upper arcade
  - sharp points on the inside of the lower arcade
  - lost teeth
  - retained caps
  - malocclusions
  - Rostral and Caudal hook.

- Release the tongue
- Smell your hand
- Repeat on the other side

Not all patients will need care. For those who do, formulate a plan to address dental disease and perform prophylactic dental care.

We are not

- creating bit seats,
- floating all surfaces of the tooth until they are completely smooth, etc…

We address problems i.e.

- remove points that cause oral ulcers
- extract infected or lose teeth
- reduce overgrown teeth

The most common problem associated with learning dentistry is inadequate pressure or movement to remove tooth while floating. Do not waste your time. If the speculum is open, move forward.

Floating should involve a routine system

- Start with the upper arcade
  - Floating the upper arcade without a speculum, using hand floats will:
    - Reduce the amount of time a speculum is in place,
    - Help teach proper blade angle. (If your blade is incorrectly angled the patient can bite it).
  - Start in the middle of the upper arcade.
  - Use straight head float
  - Hold blade at 45° angle to points/tooth
  - Use short light strokes.
  - Increase stroke in length and strength as movement gets easier
  - Listen for change in tone from higher to lower and hollow, indicating points have been removed
  - To assess effectiveness look at where the tooth particles are on the blade.
    - Even distribution = good blade angle
    - Tooth only on blade tip = move handle medially (toward you)
    - Tooth particle on near end of blade = move handle laterally (away from you)
- If the patient can bite the blade, your angle is incorrect
- Finish the upper arcades starting the lowers
  - Use a very thin blade to reach to the upper 11’s,
  - Use a slight closed angle for caudal hooks. If available,
  - Power equipment causes less trauma to the cheeks
- To utilize power equipment for (for anything other than buccal points in a quiet horse), you will need to sedate your patient, and place a mouth speculum.

**NOTE:** If you are involved in a dental procedure and are using a mouth speculum maintain a hand on the horses head. Speculums can cause serious injury if the horse moves unexpectedly.

- Address hooks on lower 11’s
- Address hooks on the 6’s and lingual points on lower arcades

### The Power Float—just the basics/Important use and storage notes

For complete information regarding the power float see the printed copy of the manuals in the back of the equine binder or visit the power float website

- *Never submerge the grinding wheel/float head into water*
- *Lube the power float after each use (daily when used)*

#### BATTERY POWERED CORDLESS MODEL OPERATION

- Only operate the adjustable clutch on setting 13 or 14.
- Only operate the rpm range selector at setting number 2.

#### TOOTH COOLING

*Do not float on a single tooth or group of teeth for longer than 10 seconds without cooling the tooth (teeth) with cold water. Repeat floating and cooling procedure as needed until procedure is completed.*

#### CHARGERS

- 15 minute wall plug battery charger
- 1 hour cigarette lighter/electrical accessory charger
EQUINE FOOT BASICS

We do not do routine hoof trimming. We will treat seriously overgrown feet, injuries to the coronary band/foot etc… Because many of our patients are not trained it may be necessary to treat/trim some horses under anesthesia. Though this is not a standard technique for handling horse’s feet, it does give students a good opportunity to learn how to trim without having to also hold the hoof up. As always: record as much information about the work performed as possible.

Introduction to the foot

The Anatomy is affected by

- Conformation
- Nutrition
- Environment – especially moisture
- Injury
  - To coronary band/foot
  - To limb resulting in increased load on contralateral limb

1. The front foot is generally wider and slightly shorter than the hind foot
2. Frog width 50 – 65% of the length
3. In a horse with “normal” confirmation
   - In the standing horse, the dorsal hoof wall should be parallel to the dorsal aspect of the pastern as well as the line of the heel
   - A line running straight down the cannon bone should hit the ground at the heel
   - A line bisecting the limb/hoof should create two mirror images
   - A line drawn across the coronary band or the palmar hoof should be perpendicular to the line bisecting the limb
   - The frog width is 50 – 65% of the length
   - The weight bearing heel falls at the widest part of the frog

While “unbalanced” the hooves pictured may have grown to “fit” the horse’s limb conformation. Trimming needs to take this into consideration.
The distance from the line of the heel to the widest part of the foot should be 2/3 the total distance between the line of the heel and the breakover point.

Breakover point is the area at the front of the foot which is touching the ground when the heel leaves the ground.

The distance from the widest part of the foot to breakover should be 1/3 of the total distance between the line of the heel and breakover.

Approaching the horse (un-anesthetized)

- Basic horsemanship
  - Quiet
  - Slow
  - Confident
- Do not go immediately for the leg
  - Start at the shoulder
  - Or to the left of the side of the head and allow the horse to investigate you
  - Take plenty of time to make physical contact and “easy conversation”
    - Run your hands over the body
    - Run your hands over the belly and flank from a safe position
    - Approach the forelimb from the shoulder
    - Approach the hindlimb from the croup
    - Face the rear and always maintain contact
- Check how horse is tied
  - Quick release knot
  - 18” to 2’ of rope
    - Horse should be able to move head
    - Should not be able to lower muzzle below the knee
  - If the horse objects, is unsafe, or the rope is not strong enough get someone to hold them.
  - The ground should be level
  - Watch the reaction when you are trying to pick up a foot and do not try to pick up the foot if the rope is tight
  - Do not pick up the foot if the horse’s contralateral limb is against a fence or object
- Holding a horse for a hoof trim
  - A good holder can make a difficult horse much easier to work with
  - Holder should stand on the same side of the horse that the farrier is working on
    - If the horse wants to turn, proper head restraint will alleviate the problem
    - Standing on contralateral side is potentially dangerous and at best will throw their weight onto the farrier
  - The holder should engage the horse by talking, rubbing, etc
o Do not twitch horses to work on their feet
o Turn the head slightly to the ipsilateral side
o Do not let the horse graze

**Approaching the recumbent horse**

- Stay away from in front of the chest and legs, and between the front and hind legs
- Work on the legs in complete extension

**Holding the foot**

- **Standing**
  - Takes practice and some muscle development
  - Exact stance will depend on horse and the farrier
  - Hoof Stand offers some advantages, especially for those who do not trim hooves frequently
- **Recumbent**
  - Hold hoof between knees facing away from the horse
  - Lean forward so that if horse moves you go away from the hooves

**Trimming**

The majority of the work that we do involves overgrown feet, with long toes. These may or may not involve chronic laminitis.

It can be difficult to decide what you need to remove on seriously overgrown feet

The second most common foot issue that we see involves a prior injury to the foot/coronary band, resulting in abnormal growth.

**What to trim**

- **Balance**
  - the definition of “hoof balance” varies from farrier to farrier and is NOT standardized
  - Generally: the hoof viewed from the front or back should be symmetrical around a line drawn down the axis of the phalangeal bones (from the fetlock to the ground)
  - HOWEVER, this is dependant on the horse’s conformation and can be difficult to evaluate in the recumbent horse
  - Attempts to “balance” or “straighten” the hooves of adult horses will result in abnormal loading of the ‘hinge’ joints of the legs and their supporting ligaments: When in doubt ask for help from experienced farrier

- **Toe/Heel length (wall)**
  - Toe and heel should be trimmed to achieve normal hoof/pastern alignment as shown above
  - Err on the side of making the hoof/pastern “broken forward” a little. This is easier on flexor/suspensory soft tissue and the dorsal surfaces of phalangeal joints
  - Optimal heel/ toe length depends on horse’s confirmation AND differs between horses and burros (and mules)
□ Excess hoof – rule of thumb: don’t trim more than you have to!
  o Frog –
    ▪ excess frog that covers the lateral sulci of the frog traps dirt and anaerobes – this should be
      removed to open the sulci
    ▪ frog confirmation is very different between horses and burros
  o Sole,
    ▪ The most recently secreted sole (sometimes called ‘live sole’) will be shiny/smooth.
    ▪ If you trim the sole too much your patient may need shoes or be sore. To avoid this:
      • Trim away the flakey older cornified sole until you can see smooth
        newer sole
      • Concentrate on making an arc at the toe, where the sole is the widest
        until you can clearly see the ‘white line’ that separates the hoof wall
        from the sole
      • Press on the new sole with a metal instrument (back of a hoof knife or
        a hoof pick) – If you can depress the sole with your instrument, you
        should not trim any more, unless you plan to put a shoe on the hoof.
      • Bonus: because you have identified the “white line” by creating this
        “Rookie Ridge” you can nip off the hoof wall abaxial to the white
        line (outside of it) without
          worrying about cutting sensitive tissue with your nippers.
    ▪ Quarter – the hoof wall is much thinner at the quarters than at the toe. Try to leave enough sole to
      support the wall and do not over-rasp the quarters. This will result in a bearing surface that is not
      level.
    ▪ Toe – thickest part of the hoof wall. Should be rounded to allow easy ‘break-over’, but leave
      enough of the tough material to support and protect the sole.
    ▪ Heel – do not over-trim! Better to leave a larger hoof angle than one that is too acute.
    ▪ White line and its significance – The white line is the most distal expression of the junction
      between the dermal and epidermal laminae. It is the “target” when driving nails to hold a horse
      shoe in place. Its recognition is essential for the diagnosis of chronic laminitis, “white line disease”,
      and most hoof abscesses.
    ▪ Bars – Do not trim the bars beyond what is necessary to remove excess horn that folds over and
      traps dirt in the crus of the sole.

Pathology

□ Thrush/canker – Infection of the cornified tissues of the hoof that ranges from bad smelling exudate in the
  colateral sulci of the frog (thrush) to a proliferative lesion (canker). Both can deform the hoof and cause
  lameness. Removal of diseased tissue, with and treatment with local antimicrobials is required. Worse in
  draft horses and animals kept in wet corrals. Much rarer in range horses.
□ Dirt – Long hooves allow the trapping of dirt, which provides an excellent environment for anaerobic
  growth. Sand and gravel can also damage the sole and wall, contributing to the development of
  abscesses.
□ Laminitis – In our environment this is usually seen in the context of chronic founder in horses prone to
  equine metabolic syndrome (mainly ponies). Trimming of “curly toes” is complicated by anatomical
  distortions in the hoof.
□ Abscess – Development of bacterial growth between the wall or sole and the under-lying sensitive
  structures occurs as a result of dirt getting through the hoof capsule. The condition is acutely painful and
  requires the establishment of drainage by removing cornified structures that trap the dirt and anaerobes.
  Certain soil types and hoof confirmations predispose a horse to abscesses.
Characteristics of good tools

- Nippers
  - Flat
    - Handmade and tempered quality steel (you get what you pay for!)
    - Very sharp and designed to maintain the cutting edge
    - Handles can range from 10” to 14”, with longer handles increasing leverage and cutting power
      (often necessary in draft cross horses on the range)
    - This tool is the most important of the trimmer’s kit
  - ½ round
    - A very handy additional tool that allows easy paring of the sole and grooving of the wall
    - Especially handy for dealing with abscesses and hoof cracks
    - BE CARFUL: these can be dangerous in the hands of the unskilled!

- Knives – both left and right handed versions
  - Handle – Should allow a ‘two hand grip’
  - Blade length –
    - Shorter blades allow more leverage in paring and can get into tighter places when opening an abscess.
    - “Loop knives” have become popular and have the advantage of having both a “left handed” and a “right handed” blade on the same knife.
  - Care – buy good quality knives and keep them sharp. A ‘diamond hone’ made for hoof knives is a must.
  - Safety – because hoof trimming takes force it is easy to slip and cause serious lacerations to the operator and the patient. Think about how you are pointing the blade before you use it!
  - Hold – hoof knives are held so that the blade is exiting the fist by the little finger and the butt of the handle is under the thumb. When possible hold the handle with two hands.
  - Hand motion – efficient trimming takes practice and requires wrist action. This will be demonstrated during clinics.

- Rasp
  - Do not skimp on rasp quality. When they wear out, get a new one.
  - Farrier’s rasps only cut one way (away from the handle). Attempting to rasp the other direction is wasted effort.
  - Pressure is applied to the end of the rasp away from the handle and this end is used to “pull” the rasp across the hoof. The other hand “steers” the rasp with the handle.
  - Two handed rasping is much more efficient and will save your knuckles!

- Pull offs – look like nippers but are a cheap dull tool for removing horseshoes. “Crease pullers” do the same thing but just one nail at a time. These are particularly useful in shod horses that have laminitis or cracked hooves.
Crease Pullers (Nail Pullers)

Clinch cutter – Before a shoe is pulled the clinches that hold it in place should be cut.

**A basic introduction to the hoof trim;**

Typical overgrown & cracked Hoof

Clean and examine

Using hoof knife, held as shown here, pare out excess sole and frog.

Create a flat surface inside the ‘white line’. Note: handler is holding hoof for demonstration. Normally, paring would be done with hoof held by handler’s legs or on hoof stand.

Once the white line has been identified this can be done safely and accurately. Generally, start at one heel and nip around to hoof until all excess hoof wall has been removed. Overlap each nip to make a nice smooth surface. When this is done properly there will be few uneven areas that require rasping. (See below)

Foot properly held by farrier’s legs. Both hands are now available.
Using the flat surface as a guide to nip excess hoof wall.

As a general principle, most of the work should be done with the knife and nippers. This is more efficient and will result in a flatter bearing surface.

Once the bearing surface is smooth, flat, and balanced, the edge of the wall is rasped to remove flares.